Radiological Health Data.

VOLUME III, NUMBER 1
QUARTERLY REPORT

JANUARY 1962

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service

In August 1959, the President directed the Secretary of Health, Education, and Welfare to intensify Departmental activities in the field of radiological health. The Department was assigned responsibility within the Executive Branch for the collation, analysis and interpretation of data on environmental radiation levels. The Department delegated this responsibility to the Division of Radiological Health, Public Health Service.

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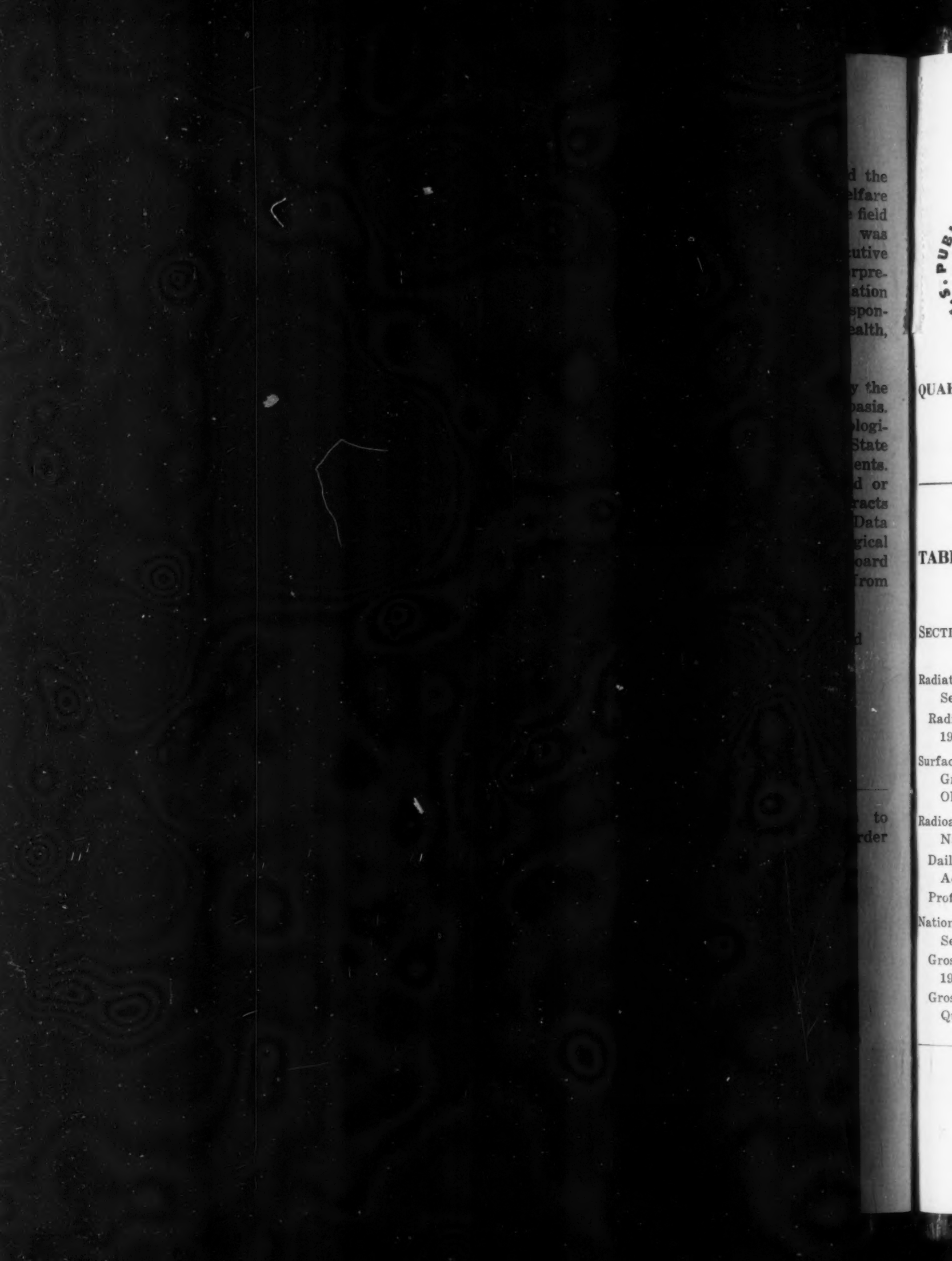

RADIOLOGICAL HEALTH DATA

QUARTERLY REPORT JANUARY 1962 VOLUME III, NUMBER 1

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Radiation Surveillance Network

Division of Radiological Health, Public Health Service

The Public Health Service Radiation Surveillance Network was established in 1956 in cooperation with the Atomic Energy Commission to provide a means of promptly determining increases in levels of radioactivity in air due to fallout from nuclear weapons tests. Prior to September 1961, it consisted of 45 stations at urban locations operated by State and local health department personnel with 2 of the stations operated by Public Health Service personnel. Following the Soviet Union's resumption of nuclear weapons testing in the atmosphere during September, the network has been expanded to nearly 60 stations (see Figure 1).

Measurements of gross beta radioactivity in air at ground level are taken because they provide one of the earliest and most sensitive indications of increases of activity in the environment and thus act as an "alert" system. A direct evaluation of biological hazards is not possible from these data alone.

Air is drawn through a cellulose carbon-loaded dust filter using a high volume air sampler. The radioactive material in fallout adhering to small particles is retained on the filter. Some gaseous fission products are adsorbed by the carbon. Field measurements enable the operator to estimate the amount of beta activity of particulates in air at the station five hours after collection by comparison with a known source using a portable survey meter. The filters are then forwarded to the central laboratory of the Radiation Surveillance Network in Washington, D. C., for a more refined measurement using a thin-window proportional counter. The station located at Atlanta, Georgia, conducts its own laboratory analyses.

Table 1 presents the monthly summary report of fission product gross beta concentrations in surface air during October 1961. Daily laboratory results will no longer be published in *Radiological Health Data* unless a marked increase in levels is again observed.

FIGURE 1.—RADIATION SURVEILLANCE NETWORK SAMPLING STATIONS

ABLE 1.—RADIOACTIVITY OF PARTICULATES IN AIR, OCTOBER 1961 GROSS BETA DETERMINATIONS

Station location		Number samples	Maximum ($\mu\mu c/m^3$)	Minimum ($\mu\mu c/m^3$)	Average[1] ($\mu\mu c/m^3$)	Station location		Number samples	Maximum ($\mu\mu c/m^3$)	Minimum ($\mu\mu c/m^3$)	Average[1] ($\mu\mu c/m^3$)
City	State					City	State				
Anchorage	Alaska	31	15	0.54	4.1	Pascagoula	Mississippi	25	19	2.9	9.1
Fairbanks	Alaska	30	5.9	0.18	2.9	Jefferson City	Missouri	30	16	1.3	7.2
Juneau	Alaska	31	10	0.23	2.9	Helena	Montana	30	40	1.1	9.4
Kodiak	Alaska	2	3.2	1.6	2.5	Trenton	New Jersey	31	20	1.3	8.4
Phoenix	Arizona	30	57	2.5	19	Sante Fe	New Mexico	31	30	1.5	12
Little Rock	Arkansas	31	15	1.5	7.3	Albany	New York	31	16	0.86	8.1
Berkeley	California	30	35	1.5	12	Gastonia	North Carolina	31	31	2.2	11
Los Angeles	California	30	19	1.5	9.4	Bismarck	North Dakota	31	36	0.73	6.9
Denver	Colorado	30	30	1.0	8.7	Columbus	Ohio	31	24	1.1	9.5
Hartford	Connecticut	30	17	1.6	7.7	Oklahoma City	Oklahoma	3	25	0.69	9.9
Washington	District of Columbia	31	23	2.6	8.9	Ponca City	Oklahoma	31	14	0.28	5.1
Jacksonville	Florida	31	49	<0.10	14	Portland	Oregon	31	36	1.1	11
Miami	Florida	31	40	<0.10	5.9	Harrisburg	Pennsylvania	27	26	2.6	8.9
Atlanta	Georgia	31	35	2.6	9.8	San Juan	Puerto Rico	22	2.3	<0.10	1.0
Honolulu	Hawaii	31	5.2	<0.10	2.0	Providence	Rhode Island	31	23	0.78	8.2
Boise	Idaho	30	71	1.6	16	Columbia	South Carolina	30	33	1.9	8.8
Springfield	Illinois	30	19	1.5	8.5	Pierre	South Dakota	31	31	1.2	8.5
Indianapolis	Indiana	31	27	2.2	8.5	Nashville	Tennessee	31	36	1.6	9.5
Iowa City	Iowa	31	18	0.63	6.2	Austin	Texas	30	22	1.3	7.7
Topeka	Kansas	31	23	1.3	8.1	El Paso	Texas	29	70	1.8	13
Frankfort	Kentucky	30	39	2.0	8.8	Salt Lake City	Utah	31	38	1.3	8.9
New Orleans	Louisiana	31	26	1.6	7.3	Richmond	Virginia	31	22	3.5	8.9
Baltimore	Maryland	31	28	3.0	10	Seattle	Washington	26	8.7	1.0	3.1
Lawrence	Massachusetts	30	16	0.82	5.1	Madison	Wisconsin	31	21	1.2	7.1
Lansing	Michigan	31	24	2.3	10	Cheyenne	Wyoming	31	28	0.58	8.3
Minneapolis	Minnesota	31	18	0.74	6.1	Sundance	Wyoming	2	22	8.3	15
Jackson	Mississippi	22	18	1.6	6.6						
						Network average					8.4

[1] Weighted average obtained by summing the products of individual sampling times and the corresponding activities, and dividing by the summation of the individual sampling times.

Surface Air Radon, Thoron, and Fission Product Gross Beta Concentrations at Cincinnati, Ohio

Robert A. Taft Sanitary Engineering Center, Public Health Service

The determination of natural background radiation in our atmosphere is useful because the exposure levels from natural radiation can be used as a base for comparative evaluations of exposures from artificially produced radionuclides. Natural radioactivity in surface air is attributed to a number of unstable nuclides other than those produced by man. The earth's crust contains trace amounts of uranium and thorium that occur naturally and which decay through a series of their daughter products. These decay products of uranium and thorium are introduced into surface air through their rare gas daughters, radon (radon–222) and thoron (radon–220), which in turn continue to decay through the uranium and thorium series, respectively. The radon and thoron content of air depends on the escape of these rare radioactive gases from the earth. Concentrations depend on prevailing atmospheric conditions such as ambient temperature, humidity, and pressure, and on soil conditions such as moisture, porosity, and temperature.

Most of the natural radioactivity in surface air is due to radon (Rn^{222}) and its daughters. Thoron (Rn^{220}) and its daughters contribute much less because of thoron's short half-life and hence, a lower diffusion rate from the soil.

Radiological Health Research Activities, Research Branch, Division of Radiological Health, Public Health Service, performs a continuous daily sampling program for radon (Rn^{222}), thoron (Rn^{220}), and gross beta fission product concentrations in surface air. The gross beta activity of atmospheric particulates, when measured several days after sample collection, is principally due to artificially produced radionuclides.

Radon–222 concentrations are determined from alpha measurements made immediately

after the sampling period (24 to 72 hours) has ceased. Radon–222 (a.m.) concentrations have been corrected for any radon–220 daughter interferences. Radon–222 (p.m.) concentrations are derived from alpha measurements made in the afternoon (3 p.m.) approximately 7 hours after the new sampling period has begun. These values are from the same filters that are counted at 8 a.m. the following day. Radon–222 (p.m.) concentrations are uncorrected for any radon–220 daughter interferences. Radon–220 concentrations are determined from alpha measurements made on the sample used to evaluate the corrected radon–222 (a.m.) concentrations, but are counted 7 hours after the sampling period has ceased. Reported values are corrected to the time of removal of the filter.

The data are now computed by an electronic data processing system which is programmed for thirteen four-week periods per calendar year. The data for the period September 11–October 6, 1961, appears in table 1.

REFERENCE

Setter, L. R. and G. I. Coats "The Determination of Airborne Radioactivity," *American Industrial Hygiene Association Journal, 22,* No. 1, Feb. 1961.

TABLE 1.—SURFACE AIR RADON (Rn^{222}), THORON (Rn^{220}), AND FISSION PRODUCT GROSS BETA CONCENTRATIONS, SEPTEMBER 11–OCTOBER 6, 1961

End of sampling period	Continuous sample collection			Rn^{222} 8 a.m. ($\mu\mu c/m^3$)	Rn^{222} 3 p.m. ($\mu\mu c/m^3$)	Rn^{220} ($\mu\mu c/m^3$)	Beta activity ($\mu\mu c/m^3$)
	Sample change time	Sample period (hours)	Volume (m^3)				
September 11	0808	71.8	86.2	780	130	8.5	<0.01
12	0805	23.9	29.3	710	140	6.2	—
13	0808	24.0	29.5	460	70	4.4	0.02
14	0808	24.0	29.0	140	130	2.3	0.05
15	0805	23.9	29.1	140	50	1.1	0.57
18	0815	72.1	89.4	1080	140	2.0	12.96
19	0812	23.9	30.4	850	190	8.0	30.10
20	0807	23.9	30.3	570	180	6.4	16.04
21	0815	24.1	30.0	580	150	4.3	15.44
22	0804	23.8	29.9	470	110	4.6	44.97
25	0810	72.1	90.7	250	120	5.3	3.35
26	0810	24.0	30.0	160	70	1.2	0.95
27	0815	24.0	30.0	1370	130	11.0	2.86
28	0805	23.8	29.4	250	170	5.8	2.99
29	0800	23.9	29.1	1010	160	7.4	5.38
October 2	0810	72.1	87.6	230	100	2.0	3.27
3	0802	23.8	29.2	170	120	1.7	4.93
4	0811	24.1	29.8	1080	120	4.3	5.99
5	0807	23.9	29.4	450	120	4.5	5.08
6	0802	23.9	29.2	900	190	4.9	8.47
Average				580	130	4.8	8.2
Range of counting errors (2σ)							
Maximum				64	23	1.1	0.6
Minimum				21	14	0.3	0.01

Radioactivity Measurements In Surface Air

U.S. Naval Research Laboratory

Radioactivity measurements of air-filter samples collected at various sites near the 80th Meridian (West) are made by the U.S. Naval Research Laboratory under a program partially financed by the Atomic Energy Commission.

The daily record of fission product beta activity during August 1961 is presented in table 1, and the radioactivity profile for the same month and the second quarter of 1961 are shown in figure 2. This figure illustrates the data plotted in semilogarithmic coordinates. The abscissa is expressed in micromicrocuries per cubic meter of surface air. The concentrations in table 1 are expressed in disintegrations per minute per cubic meter of air at the collecting site (2.2 disintegrations per minute per cubic meter equals 1 micromicrocurie per cubic meter).

FIGURE 1.—ATMOSPHERIC RADIOACTIVITY SAMPLING STATIONS NEAR THE 80TH MERIDIAN (WEST)

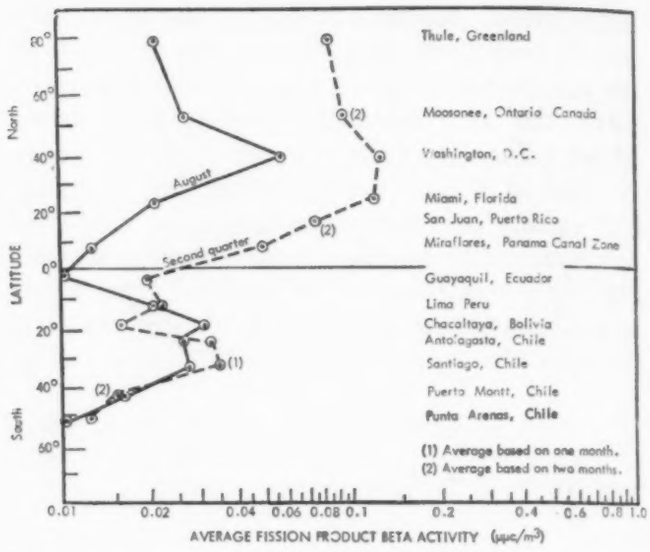

FIGURE 2.—PROFILE OF BETA ACTIVITY, AVERAGE MEASUREMENTS OF SURFACE AIR AT STATIONS NEAR THE 80TH MERIDIAN (WEST), SECOND QUARTER AND AUGUST 1961

TABLE 1.—DAILY RECORD OF FISSION PRODUCT GROSS BETA ACTIVITY IN SURFACE AIR, AUGUST 1961

[Disintegrations/minute per cubic meter]

Day	Punta Arenas, Chile	Puerto Montt, Chile	Santiago, Chile	Antofagasta, Chile	Chacaltaya, Bolivia	Lima, Peru	Guayaquil, Ecuador	Miraflores, Panama Canal Zone	Miami, Florida	Washington, D. C.	Moosonee, Ontario, Canada	Thule, Greenland
1	0.03	0.05	----------	0.04	0.11	0.04	0.04	0.04	0.06	0.14	0.06	0.08
2	0.03	0.05	----------	0.04	0.11	0.04	0.04	0.04	0.06	0.14	0.06	0.08
3	0.02	0.06	----------	0.04	0.11	0.04	0.04	0.04	0.06	0.14	0.06	0.08
4	0.02	0.06	----------	0.04	0.11	0.04	0.04	0.04	0.06	0.14	0.06	0.08
5	0.02	0.04	----------	0.04	0.11	0.04	0.04	0.04	0.06	0.14	0.06	0.08
6	0.02	0.04	----------	0.04	0.11	0.04	0.04	0.04	0.06	0.14	0.06	0.08
7	0.02	0.04	----------	0.04	0.11	0.04	0.04	0.04	0.06	0.14	0.06	0.08
8	0.03	0.03	0.05	0.06	0.06	0.07	0.01	0.02	0.04	0.17	0.07	0.05
9	0.03	0.03	0.05	0.06	0.06	0.07	0.01	0.02	0.04	0.17	0.07	0.05
10	0.01	0.06	0.05	0.06	0.06	0.07	0.01	0.02	0.04	0.17	0.07	0.05
11	0.01	0.06	0.05	0.06	0.06	0.07	0.01	0.02	0.04	0.17	0.07	0.05
12	0.03	0.03	0.05	0.06	0.06	0.07	0.01	0.02	0.04	0.17	0.07	0.05
13	0.03	0.03	0.05	0.06	0.06	0.07	0.01	0.02	0.04	0.17	0.07	0.05
14	0.03	0.03	0.05	0.06	0.03	0.07	0.01	0.02	0.04	0.17	0.07	0.05
15	----------	0.04	0.08	0.05	0.03	0.04	0.01	0.02	0.03	0.17	0.07	0.04
16	0.03	0.04	0.08	0.05	0.03	0.04	0.01	0.02	0.03	0.17	0.07	0.04
17	0.03	0.03	0.08	0.05	0.03	0.04	0.01	0.02	0.03	0.17	0.07	0.04
18	0.03	0.03	0.08	0.05	0.03	0.04	0.01	0.02	0.03	0.17	0.07	0.04
19	0.02	0.01	0.08	0.05	0.03	0.04	0.01	0.02	0.03	0.17	0.07	0.04
20	0.02	0.01	0.08	0.05	0.03	0.04	0.01	0.02	0.03	0.17	0.07	0.04
21	0.02	0.01	0.08	0.05	0.03	0.04	0.01	0.02	0.03	0.17	0.07	0.04
22	----------	0.04	0.07	----------	0.09	0.03	0.02	0.03	----------	0.04	0.04	0.02
23	----------	0.04	0.07	----------	0.09	0.03	0.02	0.03	----------	0.04	0.04	0.02
24	----------	0.04	0.07	----------	0.09	0.03	0.02	0.03	----------	0.04	0.04	0.02
25	----------	0.04	0.07	----------	0.09	0.03	0.02	0.03	----------	0.04	0.04	0.02
26	----------	0.03	0.07	----------	0.09	0.03	0.02	0.03	----------	0.04	0.04	0.02
27	----------	0.03	0.07	----------	0.09	0.03	0.02	0.03	----------	0.04	0.04	0.02
28	----------	0.03	0.07	----------	0.09	0.03	0.02	0.03	----------	0.04	0.04	0.02
29	<0.01	0.03	0.03	0.12	0.04	0.07	0.02	0.03	0.07	0.10	0.06	0.04
30	<0.01	0.03	0.03	0.12	0.04	0.07	0.02	0.03	0.07	0.10	0.06	0.04
31	<0.01	0.03	0.03	0.12	0.04	0.07	0.02	0.03	0.07	0.10	0.06	0.04
Mean (dpm/m³)	0.022	0.036	0.062	0.059	0.068	0.047	0.020	0.028	0.047	0.12	0.060	0.047
Mean (μμc/m³)	0.010	0.016	0.028	0.026	0.031	0.021	0.010	0.013	0.021	0.057	0.027	0.021

National Air Sampling Network

Division of Air Pollution, Public Health Service

The Public Health Service developed its National Air Sampling Network in 1953 to secure basic data on the nature and extent of air pollution throughout the United States, and to detect trends in levels of pollution with respect to time, location, population density, climate, and other factors associated with air quality.

The current basic network consists of 103 sampling stations operating every year in 66 large cities and 37 nonurban areas. In addition to these every-year stations, 126 cities have stations which operate every other year. Thus, there are 229 sampling stations in all, of which about 166 are active in any given year. A list of National Air Sampling Network Stations appeared in the May 1960 issue of *Radiological Health Data.*

The network stations are manned by cooperating Federal, State, and local agencies. Twenty-four hour samples of suspended particulate matter representing approximately 2000 cubic meters of air are collected on glass fiber filters on a biweekly random sampling schedule. The analyses of these samples include the measurement of total quantity of suspended particulate matter, the organic matter soluble in benzene, and gross beta radioactivity. Selected samples are analyzed also for nitrates and sulfates, and for a number of metals.

Quarterly reports of individual sample data and annual summaries are distributed to all participating agencies and State health departments. A comprehensive report on the first five years of operation of the Network is contained in the publication, *Air Pollution Measurements of the National Air Sampling Network,* Public Health Service Publication No. 637, 1958; for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., price $2.00. Gross beta activity, by States, for the years 1953 through 1958 was submitted by the Chief, Division of Radiological Health, Public Health Service, in testimony before the Joint Committee on Atomic Energy Hearing on Fallout from Nuclear Weapons Tests, Vol. 1, May 1959, pages 173–185.

Previous data on gross beta activities of particulates in surface air were published in *Radiological Health Data,* Volume I, Numbers 7 and 8, and Volume II, Numbers 1, 4, 7 and 10. Data for the third quarter 1961 are presented in tables 1 and 2 respectively. The increased levels are due to the resumption of atmospheric nuclear weapons testing during September by the USSR. The maximum values may not portray an accurate presentation, as some stations may have completed their sampling for the quarter prior to the arrival of fallout.

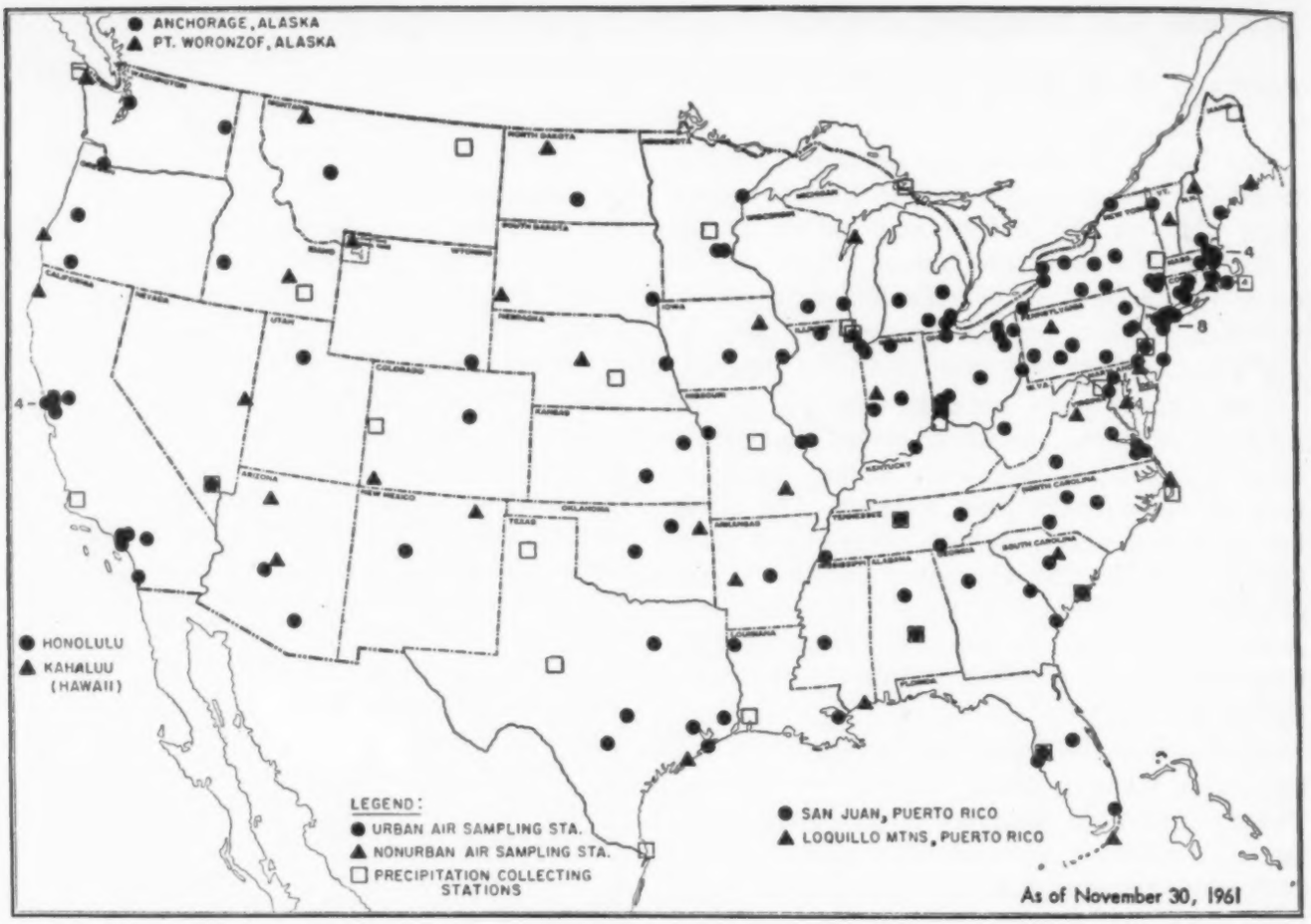

FIGURE 1.—NATIONAL AIR SAMPLING NETWORK SAMPLING STATIONS

TABLE 1.—GROSS BETA RADIOACTIVITY IN SURFACE AIR, THIRD QUARTER 1961

[Concentrations in $\mu\mu c/m^3$]

Station location	Number of samples	Minimum	Maximum	Average
Arcadia Nat. Pk., Maine [1]	7	<0.1	6.3	1.1
Akron, Ohio	7	0.1	0.6	0.2
Albany, N.Y.	6	<0.1	20.0	3.4
Albuquerque, N.M.	4	0.1	0.2	0.1
Allentown, Pa.	7	0.1	16.9	4.6
Altoona, Pa.	5	0.1	8.7	3.0
Anchorage, Alaska	7	<0.1	12.2	1.8
Atlanta, Ga.	6	<0.1	0.2	0.1
Atlantic City, N.J.	6	<0.1	0.1	0.1
Augusta, Ga.	7	<0.1	12.3	2.3
Austin, Tex.	6	<0.1	0.1	<0.1
Baltimore, Md.	7	<0.1	5.2	0.8
Beaumont, Tex.	6	<0.1	1.1	0.2
Berkeley, Calif.	7	<0.1	19.8	3.8
Bethlehem, Pa.	6	0.1	0.2	0.1
Binghamton, N.Y.	6	0.1	2.0	0.4
Birmingham, Ala.	7	<0.1	7.5	1.5
Bismarck, N.D.	7	0.1	5.9	1.0
Black Hills Frst., S.D. [1]	3	0.1	0.1	0.1
Boise, Idaho	7	0.1	14.3	3.3
Boston, Mass.	6	<0.1	0.8	0.2
Brockton, Mass.	7	0.1	11.0	1.7
Burlington, Vt.	7	<0.1	1.1	0.2
Butte County, Idaho [1]	6	0.1	4.0	0.8
Calvert County, Md. [1]	6	<0.1	0.1	0.1
Cambridge, Mass.	7	<0.1	53.0	7.9
Canton, Ohio	7	0.1	9.8	1.5
Cape Hatteras, N.C. [1]	7	<0.1	31.0	5.7
Cape Vincent, N.Y. [1]	7	<0.1	6.7	1.2
Charleston, S.C.	6	<0.1	9.8	1.7
Charleston, W. Va.	7	<0.1	3.9	0.6
Charlotte, N.C.	7	<0.1	3.3	0.8
Chattanooga, Tenn.	7	<0.1	11.0	1.6
Cherokee County, Okla. [1]	7	<0.1	9.1	1.4
Cheyenne, Wyo.	7	<0.1	46.2	7.3
Chicago, Ill.	6	<0.1	0.2	0.1
Cincinnati, Ohio	7	0.1	6.8	1.1
Clallam County, Wash. [1]	6	<0.1	1.8	0.4
Clarion County, Pa. [1]	6	<0.1	8.1	1.4
Clayton County, Iowa [1]	7	<0.1	12.0	2.1
Cleveland, Ohio	7	<0.1	30.2	4.4
Colfax County, N. Mex. [1]	3	0.1	0.1	0.1
Columbia, S.C.	7	<0.1	13.1	1.9
Columbus, Ohio	7	<0.1	63.9	9.6
Coos County, N.H. [1]	6	<0.1	22.1	5.8
Curry County, Oreg. [1]	6	<0.1	4.4	0.8
Dallas, Tex.	4	<0.1	0.1	0.1
Davenport, Iowa	7	<0.1	15.3	2.6
Dayton, Ohio	7	<0.1	4.3	0.7
Dearborn, Mich.	7	0.1	26.9	3.9
Denver, Colo.	6	<0.1	1.6	0.3
Des Moines, Iowa	6	<0.1	8.8	1.9
Detroit, Mich.	7	<0.1	36.1	5.2
Door County, Wis. [1]	3	0.1	14.6	4.9
Duluth, Minn.	7	<0.1	7.8	1.3
East Chicago, Ind.	5	<0.1	9.5	3.3
East St. Louis, Ill.	6	<0.1	0.1	0.1
Elmira, N.Y.	6	<0.1	0.2	0.1
Erie, Pa.	5	<0.1	0.2	0.1
Eugene, Oreg.	4	<0.1	0.6	0.2
Flint, Mich.	7	0.1	12.2	1.8
Florida Keys, Fla. [1]	5	<0.1	4.9	1.8
Galveston, Tex.	7	<0.1	9.0	1.4
Glacier Nat. Pk., Mont. [1]	6	<0.1	14.3	2.9
Glen Cove, N.Y.	5	0.1	0.3	0.1
Glendale, Calif.	7	<0.1	8.9	1.4
Grand Canyon Pk., Ariz. [1]	7	<0.1	5.4	1.4
Greensboro, N.C.	6	<0.1	0.2	0.1

TABLE 1.—GROSS BETA RADIOACTIVITY IN SURFACE AIR, THIRD QUARTER 1961—Continued

[Concentrations in $\mu\mu c/m^3$]

Station location	Number of samples	Minimum	Maximum	Average	Station location	Number of samples	Minimum	Maximum	Average
Hamilton, Ohio	7	0.1	8.0	1.3	Pittsburgh, Pa	7	0.1	3.1	0.5
Hammond, Ind	7	<0.1	10.2	1.5	Portland, Maine	7	<0.1	0.2	0.1
Hampton, Va	6	<0.1	2.6	0.5	Portland, Oreg	7	<0.1	6.9	1.0
Hartford, Conn	5	0.1	6.1	1.3	Portsmouth, Va	5	<0.1	75.0	15.1
Helena, Mont	5	0.1	0.2	0.1	Providence, R.I	4	<0.1	1.2	0.5
Honolulu, Hawaii	6	<0.1	4.2	1.1	Pt. Woronzof, Alaska [1]	7	<0.1	3.0	0.6
Houston, Tex	7	<0.1	7.6	1.5	Raleigh, N.C	6	<0.1	5.7	1.9
Humboldt County, Calif. [1]	6	<0.1	13.6	2.3	Richland County, S.C. [1]	6	<0.1	11.0	1.9
Indianapolis, Ind	5	0.1	0.1	0.1	Richmond, Va	7	<0.1	21.8	3.2
Jackson, Mich	6	0.1	5.2	1.0	Roanoke, Va	6	<0.1	0.2	0.1
Jackson, Miss	6	<0.1	1.6	0.3	Rochester, N.Y	7	<0.1	1.4	0.3
Jackson County, Miss. [1]	7	<0.1	247.9	35.4	Rockford, Ill	7	0.1	6.9	1.2
Jersey City, N.J	6	0.1	21.4	3.7	Salt Lake City, Utah	6	<0.1	17.3	5.4
Johnstown, Pa	5	<0.1	8.0	3.1	San Antonio, Tex	7	<0.1	227.7	34.6
Kahaluu, Hawaii [1]	7	<0.1	2.0	0.6	San Bernardino, Calif	7	<0.1	8.6	1.5
Kansas City, Mo	6	0.1	7.1	1.8	San Diego, Calif	7	0.1	6.2	1.3
Kent County, Del [1]	6	0.1	6.5	1.2	San Francisco, Calif	6	<0.1	2.0	0.4
Knoxville, Tenn	7	<0.1	9.2	1.6	San Jose, Calif	7	<0.1	11.1	2.1
Las Vegas, Nev	5	0.1	53.0	10.9	San Juan, P.R	6	<0.1	3.7	0.8
Little Rock, Ark	6	<0.1	0.1	0.1	Savannah, Ga	7	<0.1	12.2	1.8
Long Beach, Calif	6	<0.1	2.9	0.6	Schenectady, N.Y	6	<0.1	5.0	0.9
Loquillo Mtns., P.R. [1]	7	<0.1	1.8	0.3	Scranton, Pa	7	0.1	5.3	0.9
Los Angeles, Calif	7	<0.1	8.6	1.4	Seattle, Wash	7	<0.1	5.1	0.9
Louisville, Ky	6	<0.1	8.3	1.5	Shannon County, Mo. [1]	7	<0.1	6.6	1.1
Lowell, Mass	6	<0.1	24.4	4.8	Shenandoah Nat. Pk., Va. [1]	4	<0.1	17.9	4.5
Madison, Wis	6	<0.1	38.8	6.6	Shreveport, La	6	<0.1	262.9	44.2
Manchester, N.H	4	0.1	17.5	6.0	Sioux Falls, S.D	7	<0.1	12.3	2.6
Maricopa County, Ariz. [1]	7	0.1	11.6	1.8	South Bend, Ind	7	<0.1	9.5	1.4
Massena, N.Y	7	0.1	5.5	0.9	Spokane, Wash	7	0.1	10.5	1.7
Medford, Oreg	7	0.1	48.0	7.5	St. Louis, Mo	7	0.1	12.0	2.4
Memphis, Tenn	7	<0.1	6.7	1.0	St. Paul, Minn	7	<0.1	12.0	2.0
Miami, Fla	6	<0.1	1.0	0.2	St. Petersburg, Fla	7	<0.1	31.7	4.6
Milwaukee, Wis	7	<0.1	8.8	1.5	Stockton, Calif	7	<0.1	19.8	2.9
Minneapolis, Minn	7	<0.1	15.9	2.3	Syracuse, N.Y	7	<0.1	6.0	1.0
Montezuma County, Colo. [1]	7	0.1	26.1	5.3	Tampa, Fla	6	<0.1	0.2	0.1
Montgomery, Ala	7	0.1	7.4	1.1	Terre Haute, Ind	7	0.1	7.2	1.3
Montgomery County, Ark. [1]	6	<0.1	0.1	<0.1	Thomas County, Nebr. [1]	7	0.1	9.9	1.5
Montgomery County, Ind. [1]	7	<0.1	7.7	1.1	Toledo, Ohio	5	0.1	4.1	0.9
Mt. Vernon, N.Y	6	<0.1	0.1	0.1	Topeka, Kans	7	<0.1	11.0	1.7
Nashville, Tenn	6	<0.1	8.5	1.5	Troy, N.Y	5	<0.1	0.1	0.1
New Bedford, Mass	6	<0.1	43.6	8.7	Tulsa, Okla	6	<0.1	12.6	2.2
New Britain, Conn	4	0.1	0.1	0.1	Tucson, Ariz	6	<0.1	0.5	0.1
New Haven, Conn	7	0.1	15.6	2.3	Utica, N.Y	7	0.1	11.4	1.9
New Orleans, La	7	<0.1	10.7	1.9	Ward County, N.D. [1]	6	<0.1	0.1	0.1
New Rochelle, N.Y	4	0.1	0.2	0.1	Washington, D.C	4	<0.1	0.1	0.1
New York, N.Y	6	0.1	0.2	0.1	Washington County, R.I. [1]	7	0.1	5.0	1.0
Newark, N.J	7	<0.1	4.5	0.7	Waterbury, Conn	6	<0.1	0.2	0.1
Niagara Falls, N.Y	5	<0.1	19.7	4.0	Wheeling, W. Va	6	<0.1	9.6	1.7
Norfolk, Va	7	<0.1	5.9	0.9	White Pine County, Nev. [1]	6	<0.1	20.3	3.7
Oakland, Calif	6	<0.1	4.8	0.9	Wichita, Kans	6	0.1	0.2	0.1
Oklahoma City, Okla	7	0.1	243.7	35.7	Wilmington, Del	6	0.1	0.1	0.1
Omaha, Nebr	7	<0.1	3.6	0.6	Worcester, Mass	5	0.1	22.7	4.6
Orange County, Vt. [1]	7	<0.1	6.1	0.9	Yellowstone Pk., Wyo. [1]	7	0.1	16.9	3.7
Orlando, Fla	5	<0.1	16.8	3.4	York, Pa	7	<0.1	46.5	7.4
Philadelphia, Pa	7	<0.1	4.9	0.8	Youngstown, Ohio	7	<0.1	1.6	0.3
Phoenix, Ariz	7	<0.1	21.0	3.2					

[1] Nonurban station.

Gross Beta Radioactivity in Precipitation

National Air Sampling Network, Precipitation Collection Section,
Division of Air Pollution, Public Health Service

During 1959 a precipitation collection and analysis program was established by the Weather Bureau Research Station in Cincinnati, Ohio, and the National Air Sampling Network. The collection stations are located at Weather Bureau offices or airport stations. Monthly composite samples of precipitation are collected at 30 stations and forwarded to the Network laboratory for analysis. A list of these precipitation collection stations is given below. Samples are analyzed for total solids and a large number of metals and nonmetals. In addition, samples representing 85 percent

or more of the official rainfall recorded at the collecting stations are analyzed for fission product gross beta radioactivity, if a large enough volume remains after the requirements for the chemical analysis have been met. Previous data were presented in *Radiological Health Data*, Volume I, Numbers 7 and 8, and Volume II, Numbers 1, 4, 7, and 10.

PRECIPITATION COLLECTION STATIONS

National Air Sampling Network

Alabama: Montgomery
California: Santa Maria
Colorado: Grand Junction
Florida: Tampa
Idaho: Pocatello
Illinois:
  Chicago (Midway Airport)
  Chicago (O'Hare Airport)
Louisiana: Lake Charles
Maine: Caribou
Maryland: Silver Hill
Massachusetts: Nantucket
Michigan: Sault Ste. Marie
Minnesota: St. Cloud
Missouri: Columbia
Montana: Glasgow
Nebraska: Grand Island
Nevada: Las Vegas
New York: Albany
North Carolina: Cape Hatteras
Ohio:
  Cincinnati (research station)
  Cincinnati (airport)
Pennsylvania: Philadelphia
South Carolina:
  Charleston
  Greenville
Tennessee: Nashville
Texas:
  Brownsville
  San Angelo
  Amarillo
Virginia: Sterling
Washington: Tatoosh Island

TABLE 1.—GROSS BETA RADIOACTIVITY OF PRECIPITATION, THIRD QUARTER 1961

Station	July		August		September	
	μμc/liter	μμc/m²	μμc/liter	μμc/m²	μμc/liter	μμc/m²
Albany, N. Y.	18	1,900	7	800	84	5,200
Amarillo, Tex.	33	2,400	9	600	[a] —	—
Brownsville, Tex.	—	—	4	300	44	11,900
Cape Hatteras, N. C.	9	500	3	700	18	1,400
Caribou, Maine	34	2,800	16	2,000	36	4,500
Charleston, S. C.	6	700	5	600	9	500
Chicago, Ill. (Midway)	16	1,200	16	1,400	38	12,400
Chicago, Ill. (O'Hare)	36	2,800	—	—	52	14,300
Cincinnati, Ohio (Airport)	11	1,200	—	—	—	—
Cincinnati, Ohio	8	1,000	18	1,600	56	4,000
Columbia, Mo.	8	1,100	—	—	23	4,900
Grand Island, Nebr.	12	1,300	—	—	371	20,000
Greenville, S. C.	4	400	8	1,600	—	—
Lake Charles, La.	7	1,300	17	1,500	12	1,000
Montgomery, Ala.	7	700	6	1,100	—	—
Nantucket, Mass.	44	6,500	—	—	131	11,700
Nashville, Tenn.	5	400	12	600	—	—
Philadelphia, Pa.	13	1,400	9	700	23	1,300
Saulte St. Marie, Mich.	—	—	—	—	145	18,600
St. Cloud, Minn.	26	2,100	14	1,000	1,257	97,300
Sterling, Va.	17	1,200	16	1,300	27	2,300
Tampa, Fla.	3	300	—	—	—	—

[a] Dash indicates no data available due to low collection efficiency or inadequate sample.

SECTION II. — FOOD OTHER THAN MILK

Strontium-90 in U.S. Wheat Harvested in 1960[1]

Joseph Rivera
Health and Safety Laboratory, U.S. Atomic Energy Commission

Preliminary results on the strontium–90 and calcium content of U.S. wheat harvested in 1960 are presented below. Data on wheat harvested in 1959 in the same state, are presented with the 1960 results to facilitate comparison. A pictorial representation of the data is presented in figure 1. Each cube, scaled to represent the concentration, is placed on the appropriate state.

The effects of the decreased fallout rate in

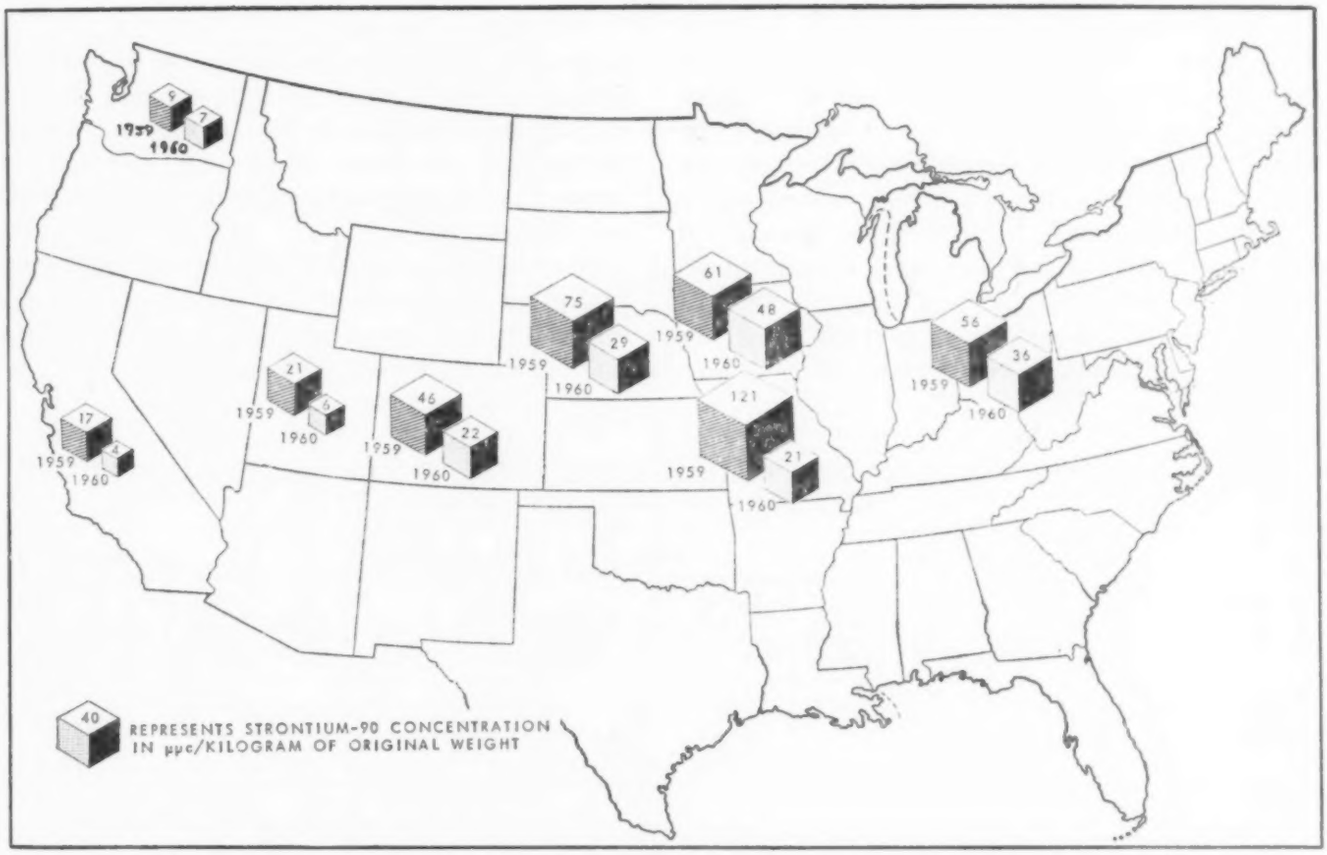

FIGURE 1.—STRONTIUM–90 IN U.S. WHEAT HARVESTED IN 1959 AND 1960

[1] Taken from *Quarterly Summary Report, HASL–115*, October 1, 1961.

TABLE 1.—STRONTIUM-90 IN U. S. WHEAT, 1959–1960

State	μμc/kg original weight		μμc/gm Ca	
	1959	1960	1959	1960
California	17	4	49	11
Colorado	46	22	71	45
Iowa	61	48	109	89
Missouri	121	21	272	50
Nebraska	75	29	159	60
Ohio	56	36	152	72
Utah	21	6	45	15
Washington	9	7	29	20

1960 as compared to that in 1959 are evident in the observed decreased strontium–90 levels in the 1960 wheat crop. The fallout rate in the United States in 1959 for the harvest months of May, June, July, and August is estimated to have been about 1.4 mc $Sr^{90}/mi^2/mo$, while in 1960 the rate was about 0.3 mc $Sr^{90}/mi^2/mo$. The increase in the cumulative strontium–90 in the soils on which the wheat was grown is estimated to have been from 66 mc/mi^2 at the end of 1959 to 70 mc/mi^2 at the end of 1960.

A more quantitative estimate of the relative importance of the fallout rate and the cumulative strontium–90 levels in the soil on the strontium–90 content of wheat will be attempted when the results of analyses on the 1960 wheat and milling products from seven additional states are available.

Other data on wheat have been presented in *Radiological Health Data*, Volume I, Numbers 2, 7 and 8 and Volume II, Numbers 4 and 7.

Strontium-90 in Various Types of Grains[1]

Health and Safety Laboratory, U.S. Atomic Energy Commission

Samples of wheat, barley, oats, and rye were collected at one site and all but rye at another during two harvest periods, and analyzed for strontium–90 to ascertain whether correlations exist among grain types and between sites.

From the data in table 1 there appears to be no correlation between the strontium–90 level in a particular type of grain grown in Warsaw, Virginia and the same type grown in Lafayette, Indiana. Furthermore, there is considerable variability among grain types at a site with regard to strontium–90 activity per unit weight of grain as well as the strontium–90 activity per gram of calcium. Finally, no trend can be observed in the data between the two harvest periods.

It would be extremely difficult to isolate one factor as the predominant contributor to the variability among grain types, between sites, and between harvest periods.

TABLE 1.—COMPARISON OF STRONTIUM-90 AND CALCIUM LEVELS IN DIFFERENT GRAINS AT TWO SITES FOR TWO HARVEST PERIODS

Site	Year	Wheat			Barley			Oats			Rye		
		gm Ca/kg original material	μμc Sr^{90}/gm Ca	μμc Sr^{90}/kg original material	gm Ca/kg original material	μμc Sr^{90}/gm Ca	μμc Sr^{90}/kg original material	gm Ca/kg original material	μμc Sr^{90}/gm Ca	μμc Sr^{90}/kg original material	gm Ca/kg original material	μμc Sr^{90}/gm Ca	μμc Sr^{90}/kg original material
Warsaw, Va	1959	0.31	92	28	0.34	156	53	0.83	103	86	0.35	232	80
	1959–60	0.34	104	35	0.36	151	54	0.84	97	81	0.36	158	58
Lafayette, Ind	1959	0.35	130	45	0.54	46	25	0.74	23	17			
	1960	0.34	155	53	0.46	129	59	0.83	29	24			

[1] Taken from *Quarterly Summary Report, HASL–115*, October 1, 1961.

Residual Radioactivity in Canadian Foods[1]

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The following data are from a study initiated to obtain data on past and current levels of residual radioactivity in the various types of food found on the Canadian market. Analytical work on samples already on hand, some of which were obtained as far back as 1945, was initiated in December 1959. The beta activity determinations were completed in August 1960. The results presented in this article do not lend themselves to a time-correlation study, since most of the samples were either passed to this laboratory by other agencies or obtained in a non-systematic way. A detailed outline of the experimental methods and standardization and calculation procedures are reported in *HASL–115*.[1] The full report is dated May 1961.

Total beta activity (excluding the contribution of potassium–40 and other alkali metals) for each variety of foods included in this initial

TABLE 1.—TOTAL BETA RADIOACTIVITY IN CANADIAN FOODS, 1945–1961

Variety	Year packed	Year purchased	Number of samples	Average[1] μμc/kg (fresh wt)
Cereals for babies:				
Barley		1959	3	[3] ND
Corn		1959	1	ND
Mixed		1959	3	17
Oats		1959	2	83
		1961	10	41
Rice		1959	3	ND
Wheat		1959	4	50
		1961	5	50
Cereals for adults:				
Barley		1960	1	48
Bran		1960	6	150
		1961	11	150
Corn		1960	5	11
Oat		1960	7	49
Rice		1960	3	14
Wheat		1960	17	57
		1961	1	110
Others		1960	19	53
Processed vegetables and fruits for babies:[2]				
Apple and raspberry	1950		1	ND
Beets	1945		1	10
	1951		1	ND
	1956		3	6.0
Celery	1949		1	ND
	1951		1	21
	1956		3	3.9
Mixed vegetables	1947		1	ND
	1949		5	ND
	1950		3	ND
	1951		3	ND
	1957		3	16
Mushroom	1948		1	8.4
	1950		1	ND
Peas	1949		3	6.4
	1950		2	ND
	1951		1	5.1
	1956		3	5.3
Peas and carrots	1949		1	ND
	1950		1	ND
Spinach	1945		1	22
	1948		1	10
	1949		1	ND
	1956		3	13
Squash	1949		1	ND
Miscellaneous processed foods for babies:[2]				
Orange custard	1949		2	8.0
	1951		1	ND
Meat broth [2]	1947		1	ND
	1948		2	6.0
	1949		2	ND
	1950		1	ND
	1951		5	2.6
Fruit Juice:[2]				
Tomato	1949		11	14
Processed fruits:[2]				
Tomatoes	1949		4	18
Apricots	1961		5	24
Dried fruits:				
Apples		1960	2	34
Apricots		1960	2	220
		1961	5	150
Dates		1960	3	60
Figs		1960	8	140
Prunes		1960	2	39
Raisins		1960	5	83
Seafoods:				
Chicken haddies		1957	1	14
Clams		1957	3	29
Crab meat		1957	6	33
Fish cakes		1957	2	22
Lobster		1957	4	14
Oyster		1957	2	20
Sardines		1957	3	ND
Sea trout		1957	1	ND
Shrimp		1957	3	8.3
Tuna		1957	11	18
Salmon:				
Keta				
Canada		1957	8	40
Japan		1957	0	
Medium red cohoe				
Canada		1957	2	91
Japan		1957	2	80
Pink				
Canada		1957	13	14
Japan		1957	7	27
Red cohoe				
Canada		1957	5	5.0
Japan		1957	10	30
Red sockeye				
Canada		1957	27	22
Japan		1957	13	19
Bone flour		1959	10	5700
		1960	2	5900
Beverage ingredients:				
Cereal		1961	8	160
Cocoa		1961	5	270
Coffee		1961	2	140
Coffee (instant)		1961	1	200
Tea:				
Broken orange pekoe				
Ceylon	1958		2	1200
Formosa	1959		1	3900
Iran	1958		1	2900
Japan	1958		1	1600
Broken pekoe				
Ceylon	1958		4	1300
	1959		2	1300
Kenya	1959		1	1700
Black				
Ceylon	1958		1	580
Formosa	1958		1	2200

[1] Data from *Quarterly Summary Report, HASL–115*, October 1, 1961.

TABLE 1.—TOTAL BETA RADIOACTIVITY IN CANADIAN FOODS, 1945–1961—Continued

Variety	Year packed	Year purchased	Number of samples	Average[1] μμc/kg (fresh wt)
Mozambique	1959		1	790
Black broken				
Amaravilla	1958		1	600
Japan	1958		1	780
Black fannings				
Ceylon	1958		1	1900
	1959		4	2000
Kasaky	1958		1	750
Kenya	1959		1	2300
Nyasaland	1958		1	440
Green				
Japan	1958		3	4600
	1959		1	7900
Green siftings				
Japan	1958		1	9500
	1959		1	7400
Green pan-fired				
Japan	1958		2	2600
Tea mixture				
Ceylon	1958		2	830
	1959		3	870
Iran	1958		2	790
Broken mixture				
Ceylon	1959		3	1500
Mixed fannings				
Ceylon	1958		5	3500
	1959		7	1800
Tea dust				
Ceylon	1959		1	1500
Uganda	1958		1	490
Tamella broken				
Ceylon	1959		1	990

[1] Excludes the contribution of potassium-40 and other alkali metals.
[2] Values given refer to one liter of the commercial preparation.
[3] ND—Not detectable.

survey are given in table 1. In general, results are in line with published data from other countries. Bran cereals were the highest for the cereal foods. Processed vegetables and fruits were all noticeably low. Apricots and figs ranked highest for the dried fruits. The medium red cohoe salmon variety showed a higher average than other seafoods. It will be noted that salmon packed in Japan, when compared to similar types packed in Canada, had activity values of the same order of magnitude. The only exception was the red cohoe variety. Values for bone flour were high. However, due to its high calcium content, the reported activities measured in μμc Sr^{90}/gmCa units would be expected to be below 10. Tea leaves, when compared to other beverage ingredients such as cocoa, coffee, and cereals, yielded activity values which ran from 2 to 30 times higher. It was found, however, that only 10 to 16 percent of this activity passed into water solution under normal conditions, as shown in table 2. The average activity was 1.05 μμc per cup of tea for six different varieties. The average values for each type of food have been summarized in table 3.

It is planned to extend the survey to other types of food. Some of those listed in table 1 are being checked with further samples. Absolute strontium–90 and calcium determinations will be conducted on a number of samples from each type.

TABLE 2.—PERCENTAGE OF THE ORIGINAL BETA ACTIVITY PASSING INTO SOLUTION WITH DIFFERENT VARIETIES OF TEA

Original solid μμc/kg (fresh weight)	Solid[1] residue μμc/kg [2]	Solution		
		μμc/kg [2]	μμc/cup	Percent of original solid activity
2400	2200	350	0.80	14.6
4400	3200	440	1.20	10.0
3900	3200	390	1.10	10.0
1700	1400	270	0.90	15.9
1600	1300	260	0.70	16.6
7400	5800	650	1.60	8.8

[1] Solid residue refers to that amount of original solids remaining after tea is made.
[2] Refers to *kilogram of original solid* (fresh weight) used to prepare the solution. Recipe: one teaspoon of tea per cup of boiling water. Standing time before filtering: 30 minutes.

TABLE 3.—SUMMARY OF TOTAL BETA RADIOACTIVITY IN CANADIAN FOODS, 1945–1961

Type of food	Number of samples	Average μμc/kg (fresh wt)
Cereals for babies	31	38
Cereals for adults	70	73
Processed vegetables and fruits for babies [2]	46	5.9
Miscellaneous processed foods for babies [2]	3	5.3
Meat broth [2]	11	1.5
Fruit juice [2]	11	14
Processed fruits [2]	9	21
Dried fruits	27	110
Sea foods	123	23
Bone flour	12	5700
Cereal beverages	8	160
Cocoa	5	270
Coffee	3	160
Tea	58	2200

[1] Excludes contribution of potassium-40 and other alkali metals.
[2] Values given refer to one liter of the commercial preparation.

SECTION III. — MILK

Milk Monitoring Program

Division of Radiological Health, Public Health Service

Milk monitoring has been conducted by the Public Health Service since early 1957, when the first program was established to develop suitable sampling methods and radiochemical analytical proficiencies. Raw milk was initially selected for investigation. During this program, it became evident that a broader sampling program was necessary—one more directly related to the milk consumed by the population. The result was the initiation, in the first quarter of 1960, of a processed (pasteurized) milk sampling program designed to

FIGURE 1.—PASTEURIZED MILK AREA SAMPLING STATIONS

provide data represenative of the milk consumed in selected municipalities. Both programs were operated concurrently until June 1961 to permit comparison of the differences between the earlier, limited, milkshed sampling results and those of the new program.

Raw milk sampling results reported for June 1961 in the November 1961 *Radiological Health Data* were the last regular publication of such data. A summary discussion of the raw milk sampling program in the December 1961 *Radiological Health Data* presented the gross relationship between fallout and the occurrence of fission products in milk determined from this study.

Pasteurized milk surveillance is currently conducted at 60 stations (shown in figure 1) with the cooperation of State and local milk sanitation agencies, who ship samples to the PHS Southeastern and Southwestern Radiological Health Laboratories for analysis. The former analyzes samples from the 30 states generally east of the Mississippi River, and the latter analyzes samples from the Western states. Publication of data follows about four months after sample collection because of time required for shipment, processing, decay-product buildup, data compilation, and publication procedures.

The current program emphasizes (1) measurement of the levels of radioactivity of samples of pasteurized and homogenized milk consumed by the public in various regions of the country, and (2) provision of at least one sampling point within each state and additional points when indicated by widely varying conditions of the milk supply or the need to cover large population groups. Each sample is composited in proportion to the volume of milk sold by those plants supplying not less than 90 percent of a city's milk supply. Prior to September 15, this composite sample was taken from one day's sales per month and was as representative of a community's total supply as could be achieved under practical conditions. Since September 15, the sampling schedule has been accelerated.

Radioassays for strontium–90, cesium–137, strontium–89, barium–140, and iodine–131 are performed. The values for strontium–89,

TABLE 1.—RADIOACTIVITY IN MILK—PASTEURIZED MILK AREA SAMPLING STATIONS, SECOND QUARTER AND AUGUST 1961

[Radioactivity concentrations in $\mu\mu$c/liter]

Area	Calcium (gm/liter		Strontium-90		Cesium-137		Area	Calcium (gm/liter)		Strontium-90		Cesium-137	
	Second quarter	August	Second quarter	August	Second quarter	August		Second quarter	August	Second quarter	August	Second quarter	August
Palmer, Alaska	1.03	1.22	9	7	5	<5	Albuquerque, N. Mex	1.06	1.12	5	5	5	<5
Little Rock, Ark	1.21	1.18	19	16	25	10	Buffalo, N.Y	1.22	1.16	8	6	15	10
Phoenix, Ariz	0.97	1.04	5	4	5	<5	New York, N.Y	1.17	1.10	9	6	25	15
Sacramento, Calif	1.05	1.02	5	4	<5	<5	Syracuse, N.Y	1.19	1.11	7	6	15	<5
San Francisco, Calif	1.04	1.01	5	5	10	<5	Charlotte, N.C	1.26	1.26	12	13	15	10
Denver, Colo	1.01	1.04	6	6	5	10	Cincinnati, Ohio	1.24	1.24	9	7	10	<5
Hartford, Conn	1.17	1.16	9	8	30	20	Cleveland, Ohio	1.20	1.12	8	8	10	<5
Wilmington, Del	1.20	1.20	10	12	15	10	Oklahoma City Okla	1.22	1.20	8	6	5	<5
Washington, D.C	1.18	1.12	8	7	20	10	Portland, Oreg	1.05	1.10	12	13	30	10
Tampa, Fla	1.23	1.26	6	5	110	85	Philadelphia, Pa	1.18	1.18	9	9	15	15
Atlanta, Ga	1.29	1.28	10	10	20	15	Pittsburgh, Pa	1.27	1.14	12	10	20	10
Honolulu, Hawaii	0.96	1.05	4	6	10	10	San Juan, P.R	1.23	1.18	4	4	5	10
Idaho Falls, Idaho	1.04	1.04	5	6	10	<5	Providence, R.I	1.17	1.10	10	13	40	30
Chicago, Ill	1.17	1.15	8	4	10	10	Charleston, S.C	1.25	1.24	12	12	25	25
Indianapolis, Ind	1.23	1.19	8	6	10	<5	Chattanooga, Tenn	1.33	1.29	11	12	15	15
Des Moines, Iowa	1.01	1.00	7	6	5	5	Memphis, Tenn	1.30	1.24	13	12	10	<5
Wichita, Kans	1.01	1.04	8	7	10	<5	Austin, Tex	1.24	1.24	3	2	5	<5
Louisville, Ky	1.18	1.18	11	8	10	10	Dallas, Tex	1.24	1.16	9	6	10	<5
New Orleans	1.30	1.30	13	14	20	30	Salt Lake City Utah	1.01	1.11	5	4	10	<5
Portland, Maine	1.26	1.21	10	10	40	35	Burlington, Vt	1.22	1.14	8	8	15	15
Baltimore, Md	1.23	1.15	8	10	15	10	Norfolk, Va	1.26	1.22	9	8	20	10
Boston, Mass	1.21	1.19	11	9	35	30	Seattle, Wash	1.03	1.06	9	8	25	15
Detroit, Mich	1.17	1.12	8	6	15	10	Spokane, Wash	1.02	1.04	8	12	15	20
Grand Rapids	1.25	1.17	7	6	15	10	Charleston, W. Va	1.20	1.12	9	10	15	10
Minneapolis, Minn	1.07	1.12	7	11	10	15	Milwaukee, Wis	1.19	1.13	6	4	20	10
Jackson, Miss	1.35	1.22	14	12	15	10	Laramie, Wyo	1.00	1.08	5	5	10	10
Kansas City, Mo	[a] 1.08	1.00	[a] 12	8	[a] 15	<5	Average	1.16	1.14	8	8	15	10
St. Louis, Mo	1.09	1.03	8	6	20	10							
Helena, Mont	1.02	1.06	6	4	10	5							
Omaha, Nebr	1.07	1.06	6	9	10	10							
Manchester, N.H	1.23	1.17	12	10	45	40							
Trenton, N.J	1.17	1.13	9	8	15	10							

[a] Average based on two month's samples.

barium–140, and iodine–131 for August 1961 were below the levels of detection by current instrumentation and are therefore not shown in table 1. The lower level of detection for strontium–89 is 5 μμc/liter, and for barium–140 and iodine–131, 10 μμc/liter. Other radionuclides of concern to public health agencies will be included for assay as necessary for a more complete monitoring of the milk supply.

Following resumption of nuclear weapons testing in the atmosphere, the frequency of sampling was accelerated. Daily sampling of processed milk with analyses for iodine–131 content was initiated on September 19, at selected stations. The data for September 19 through October 31, 1961, have been reported in *Radiological Health Data*, Volume II, Numbers 11 and 12.

TABLE 2.—IODINE-131 DETERMINATIONS, PROCESSED MILK AREA SAMPLING STATIONS, NOVEMBER 1–30, 1961

[Concentrations in μμc/liter]

Station location	November																												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Palmer, Alaska	—	50	—	—	60	50	—	—	70	—	—	—	—	—	—	—	60	—	—	—	<10	<10	—	—	—	<10	—	<10	—	<10
Phoenix, Ariz	—	—	110	—	—	130	—	70	—	—	—	—	—	90	—	70	—	—	—	80	—	—	30	—	—	—	40	—	—	30
Little Rock, Ark	—	—	70	—	—	—	150	—	—	250	—	—	—	180	—	—	180	—	—	—	140	—	—	60	—	—	—	—	—	—
Sacramento, Calif	60	50	100	—	—	60	70	70	—	50	—	—	30	30	30	30	30	—	—	20	20	20	20	—	<10	—	10	<10	<10	<10
San Francisco, Calif	—	40	—	—	—	40	—	—	30	—	—	—	20	—	—	—	—	—	—	20	—	—	—	<10	—	—	<10	—	—	<10
Denver, Colo	—	70	—	—	—	—	—	—	40	60	—	—	—	40	—	—	—	—	—	—	—	30	20	—	20	—	—	—	—	<10
Hartford, Conn	—	—	60	—	—	—	50	—	—	30	—	—	—	20	—	—	30	—	—	—	10	—	—	10	—	—	—	<10	—	—
Wilmington, Del	—	—	140	—	—	—	70	—	—	60	—	—	—	40	—	—	50	—	—	—	30	—	—	30	—	—	—	20	—	—
Washington, D C	60	—	50	—	—	40	—	50	—	40	30	—	—	40	—	40	—	—	—	10	—	—	30	—	—	—	10	—	30
Tampa, Fla	50	—	—	—	—	50	—	50	—	40	—	—	50	—	50	—	50	—	—	40	—	60	—	—	—	—	10	—	20	—
Atlanta, Ga	30	—	—	—	—	30	—	40	—	—	—	—	40	—	40	—	30	—	—	60	—	60	—	50	—	—	40	—	10	—
Honolulu, Hawaii	—	—	—	—	—	—	10	—	30	—	—	—	—	10	—	—	20	—	—	—	<10	—	—	20	—	—	—	10	—	—
Idaho Falls, Idaho	—	200	—	—	—	110	—	—	160	—	—	—	90	—	—	70	—	—	—	30	—	—	—	—	—	10	—	—	—	—
Chicago, Ill	130	100	90	—	—	120	130	120	130	140	—	—	80	110	90	130	80	—	—	40	40	30	—	50	—	—	10	<10	<10	10
Indianapolis, Ind	—	—	—	—	—	—	—	—	—	70	—	—	80	70	—	—	60	—	—	50	—	—	—	—	—	—	—	20	—	—
Des Moines, Iowa	—	—	200	—	—	250	—	—	310	—	—	—	250	—	—	—	240	—	—	130	—	—	—	180	—	—	90	—	—	—
Wichita, Kans	90	—	80	—	100	—	—	320	—	340	—	—	—	—	220	—	260	—	—	—	130	—	—	70	—	40	—	50	—	—
Louisville, Ky	—	—	90	—	—	—	100	—	—	80	—	—	—	50	—	—	80	—	—	—	100	—	—	50	—	—	60	—	—	—
New Orleans, La	—	—	—	—	—	50	50	50	60	—	—	—	80	70	70	100	80	—	—	90	60	80	—	—	—	—	40	30	70	50
Portland, Maine	—	—	90	—	—	—	70	—	—	40	—	—	—	—	—	—	10	—	—	—	40	—	—	10	—	—	—	<10	—	—
Baltimore, Md	—	40	—	—	—	50	—	—	30	—	—	—	—	—	—	30	—	—	—	40	—	—	—	30	—	—	10	—	—	30
Boston, Mass	—	—	100	—	—	—	100	—	—	—	—	—	—	—	—	—	10	—	—	—	10	—	—	10	—	—	—	<10	—	—
Detroit, Mich	—	—	170	—	—	—	—	—	—	120	—	—	—	80	—	—	80	—	—	—	40	—	—	—	—	—	—	<10	—	—
Grand Rapids, Mich	—	—	160	—	—	—	—	—	—	80	—	—	—	—	40	—	60	—	—	—	30	—	—	10	—	—	—	10	—	—
Minneapolis, Minn	260	—	210	—	—	—	240	—	—	180	—	—	—	140	—	—	120	—	—	—	80	—	—	20	—	—	—	10	—	—
Jackscn, Miss	40	—	60	—	—	40	—	80	—	—	—	—	70	—	80	—	90	—	—	80	—	60	—	—	—	—	30	—	70	—
Pascagoula, Miss	—	—	60	—	—	—	50	—	—	60	—	—	—	70	—	—	50	—	—	—	70	—	—	—	—	—	—	20	—	—
Kansas City, Mo	—	—	130	—	—	—	240	—	—	300	—	—	—	220	—	—	180	—	—	—	140	—	—	—	—	—	90	—	—	—
St. Louis, Mo	90	80	70	100	—	110	160	180	190	200	160	—	130	120	150	120	120	90	—	70	80	70	70	50	50	—	30	30	40	30
Helena, Mont	—	220	200	190	—	—	150	—	—	—	—	60	—	—	—	140	—	—	—	—	—	—	90	—	—	50	—	—	—	<10
Omaha, Nebr	—	—	80	—	—	310	—	190	—	110	—	—	270	—	150	—	190	—	—	110	—	70	—	50	—	—	50	—	30	—
Manchester, N. H	—	—	90	—	—	—	60	—	—	50	—	—	—	40	—	—	—	—	—	—	30	—	—	—	—	—	—	10	—	—
Trenton, N. J	—	70	—	—	—	—	—	—	40	—	—	—	—	20	—	—	10	—	—	—	40	—	—	—	—	—	—	<10	—	—
Albuquerque, N. Mex	—	—	30	10	—	—	50	—	—	—	50	—	40	—	—	—	—	—	—	—	50	—	—	—	<10	—	—	30	—	—
Buffalo, N. Y	—	—	—	—	—	—	100	—	—	—	—	—	—	—	10	—	—	—	—	—	—	10	10	—	—	—	<10	<10	—	—
New York, N. Y	110	70	60	—	—	—	80	80	70	60	60	—	40	40	40	—	—	—	—	20	10	20	—	—	—	—	10	10	<10	10
Syracuse, N. Y	—	—	50	—	—	—	80	—	—	60	—	—	—	10	—	—	—	—	—	—	10	—	—	10	—	—	—	<10	—	<10
Charlotte, N. C	—	—	30	—	—	—	20	—	—	20	—	—	—	10	—	—	10	—	—	—	20	—	<10	—	—	—	10	—	—	—
Minot, N. Dak	—	—	—	—	—	—	—	—	—	—	—	—	—	—	50	—	—	—	—	—	20	—	—	60	—	—	20	—	<10	—
Cincinnati, Ohio	—	—	90	—	—	—	—	—	110	—	—	—	—	—	—	—	80	—	—	—	—	—	—	50	—	—	—	70	—	—
Cleveland, Ohio	—	—	100	—	—	—	—	—	—	80	—	—	—	30	—	—	50	—	—	—	40	—	—	30	—	—	—	<10	—	—
Oklahoma City, Okla	—	80	—	—	—	—	250	—	300	—	—	—	230	—	—	180	—	—	—	140	—	80	—	—	—	—	80	—	—	70
Portland, Oreg	300	—	—	—	—	240	—	—	—	160	—	—	—	—	—	10	—	—	—	220	—	—	—	90	—	—	—	—	—	—
Philadelphia, Pa	—	—	60	—	—	50	—	—	—	50	—	—	—	40	—	—	40	—	—	—	10	—	—	30	—	—	—	10	—	—
Pittsburgh, Pa	—	—	60	—	—	—	—	—	40	50	—	—	—	40	—	—	40	—	—	—	30	—	—	—	—	—	—	<10	—	—
San Juan, P. R	—	—	<10	—	—	—	10	—	—	<10	—	—	—	40	—	—	10	—	—	—	30	—	—	50	—	—	—	40	—	—
Providence, R. I	—	—	80	—	—	—	70	—	—	70	—	—	—	40	—	—	—	—	—	—	30	—	—	30	—	—	—	<10	—	—
Charleston, S. C	—	—	40	—	—	20	—	20	—	10	—	—	10	—	—	—	10	—	—	<10	—	30	—	10	—	—	10	—	10	—
Chattanooga, Tenn	—	—	60	—	—	—	20	—	—	40	—	—	—	20	—	—	40	—	—	—	30	—	—	30	—	—	—	40	—	—
Memphis, Tenn	—	50	—	—	—	—	60	—	150	—	—	—	—	100	—	70	—	—	—	—	70	—	—	80	—	—	—	50	—	70
Austin, Tex	40	30	30	—	60	90	70	110	70	80	60	100	50	80	40	50	—	—	—	30	40	—	—	30	40	—	50	50	80	100
Dallas, Tex	—	40	—	—	—	—	—	—	250	—	—	—	—	130	—	—	100	—	—	—	70	—	—	60	—	—	—	40	—	—
Salt Lake City, Utah	—	140	—	—	—	100	—	120	—	100	—	—	80	110	—	30	—	—	—	<10	—	20	<10	—	—	—	—	—	—	—
Burlington, Vt	—	—	90	—	—	90	—	—	—	70	—	—	—	20	—	—	—	—	—	—	—	30	—	10	—	—	<10	—	—	—
Norfolk, Va	—	—	60	—	—	—	40	—	—	30	—	—	—	20	—	—	30	—	—	—	40	—	—	30	—	—	<10	20	—	—
Seattle, Wash	290	—	200	270	—	110	120	120	140	100	120	—	100	140	190	150	140	190	—	90	90	—	80	50	40	—	30	30	30	10
Spokane, Wash	—	—	120	—	—	150	—	—	—	—	70	—	—	70	50	—	—	—	—	—	—	40	—	—	—	—	<10	—	—	<10
Charleston, W. Va	—	—	—	50	—	—	40	—	—	30	—	—	—	20	—	—	—	—	—	—	10	—	—	—	—	—	—	<10	—	—
Milwaukee, Wis	130	150	140	130	150	130	140	—	110	—	—	100	—	90	—	40	—	—	—	—	30	—	10	—	—	—	—	10	—	10
Laramie, Wyo	—	—	10	—	—	—	20	—	—	30	—	—	—	30	—	—	20	—	—	—	80	—	—	—	—	—	—	<10	—	—

To provide quick assessement of iodine–131 contamination, sampling schedules for all of the regular stations for monitoring fresh pasteurized milk have been accelerated. The samples are air shipped to the Radiological Health Laboratories for analysis. The results are phoned daily to the PHS Radiation Surveillance Center in Washington, D.C. Daily results are, in turn, reported to the State Health Departments so that they are continuously aware of their local situations.

Beginning November 1, 1961, the following sampling schedule became effective:

(a) Daily sampling at

Chicago, Ill.	New York, N.Y.
New Orleans, La.	Austin, Tex.
St. Louis, Mo.	Seattle, Wash.

(b) Three samples per week at

Palmer, Alaska	Jackson, Miss.
Sacramento, Calif.	Pascagoula, Miss.
Denver, Colo.	Omaha, Neb.
Washington, D.C.	Charleston, S.C.
Tampa, Fla.	Salt Lake City, Utah
Atlanta, Ga.	Milwaukee, Wis.
Wichita, Kans.	

(c) Two samples per week at remainder of the stations.

Table 2 presents the iodine–131 results of individual samples taken during November 1961. The results are corrected to the date the sample was collected. These samples are composited on a weekly basis for determination of strontium–89, strontium–90, and stable calcium, and will be reported in the monthly summaries.

SECTION IV. — WATER

National Water Quality Network

Division of Water Supply and Pollution Control, Public Health Service

The National Water Quality Network operates under the provision of Section 4 (c) of the Federal Water Pollution Control Act, which states ". . . The Secretary shall . . . collect and disseminate basic data . . . (relating) to water pollution and the prevention and control thereof."

This Network, operated in cooperation with State and Local agencies, and industrial organizations commenced operations in October, 1957. As of December 1, 1961, there were 97 sampling stations located on major waterways used for public water supply, propagation of fish and wildlife, recreational purposes, and for agricultural, industrial, and other uses. Some of these stations are on interstate, coastal, and International Boundary waters, and waters on which activities of the Federal Government may have an impact. Ultimately, a total of approximately 300 stations will be in operation. Radioactivity is not yet being reported for a few of the more recently established stations.

Samples of water are examined for chemical, physical, and biological quality insofar as these relate to pollution. Samples for some determinations are taken weekly, others monthly, and for some, continuous composite samples of 10 to 15 days are obtained.

Gross alpha and beta measurements are made on both suspended and dissolved solids in raw surface water samples. The levels of radioactivity associated with dissolved solids provide a rough measure of the levels which may be found in a treated water, where such water treatment removes substantially all of the suspended matter. Naturally-occurring radioactive substances in the environment are the source of essentially all of the alpha activity. The contamination of the environment from manmade sources is the major contributor to the beta activity. It should be noted that with the cessation of weapons testing for a period of three years, the beta activity in most raw waters generally had approached a level attributable solely to natural sources. Natural beta activity can be two or three times the natural alpha activity based on the presence of the same nuclides. The resumption of nuclear weapons testing in the atmosphere by the USSR has resulted in an increase in radioactivity of surface waters. Preliminary evidence obtained during October, 1961 indicates a 5- to 10-fold increase in gross beta radioactivity of the surface waters over the 1960 average in some areas, particularly in North Central, North Eastern, and Eastern United States. The greater percentage of increase in the radioactivity is in the suspended solids.

For the first two years of the Network operations, beta determinations were made on weekly

As of November 29, 1961

FIGURE 1.—NATIONAL WATER QUALITY NETWORK SAMPLING STATIONS

samples. Alpha determinations were reported generally on composites of more than one weekly sample.

Beginning January 1, 1960, the frequency of beta determinations varied depending on the status of each particular station. For the first operating year of each new station, analyses were being conducted weekly. Weekly analyses were to be continued indefinitely from all stations which may be affected by waste discharges from nuclear installations. Semimonthly determinations (on composites of 2 or 3 weekly samples) were conducted for stations which still showed some beta activity above background. Monthly determinations (on composites of all samples received from a station during the month) were conducted on samples from streams where beta activity was at background levels.

Beginning January 1, 1960, the frequency of alpha determinations also was changed. For the first operating year of each new station, analyses were to be done weekly. At some stations on the Colorado and Animas Rivers determinations were done on weekly samples or semimonthly on two- or three-week composites. The remainder of the stations were scheduled so that each had one gross alpha determination per month.

The following changes were instituted on September 1, 1961, following resumption of nuclear weapons testing:

1. Gross beta counts are to be made on all samples collected. (Compositing weekly samples for monthly or semimonthly gross alpha and beta counting will cease.)
2. Beginning with samples collected October 1, 1961, strontium–90 determinations are to be made on a three months composite of weekly samples.

Gross alpha counts are to be made on one sample for each station each month, unless there is evidence of alpha activity. In the latter instance, an alpha determination will be made on a weekly or bi-weekly basis depending on what is considered the norm for a particular station.

TABLE 1.—RADIOACTIVITY IN RAW SURFACE WATERS

[Concentrations in μμc/liter]

Station	Quarter ending June 30, 1961	July 1961					
	Strontium-90	Beta activity			Alpha activity		
		Suspended	Dissolved	Total	Suspended	Dissolved	Total
Allegheny River: Pittsburgh, Pa	0.2	0	0	0	0	1	1
Animas River: Cedar Hill, N. Mex	[a] —	8	4	12	2	3	5
Apalachicola River: Chattahoochee, Fla	—	0	2	2	0	0	0
Arkansas River:							
Coolidge, Kans	—	52	0	52	80	35	115
Ponca City, Okla	0.7	22	0	22	7	7	14
Pendleton Ferry, Ark	—	23	1	24	14	4	18
Big Sioux River: Sioux Falls, S. Dak	—	1	4	5	0	2	2
Chattahoochie River:							
Atlanta, Ga	0.3	—	—	—	—	—	—
Columbus, Ga	—	0	0	0	1	1	2
Colorado River:							
Loma, Colo	—	16	38	54	1	16	17
Page, Ariz	2.3	153	27	180	50	8	58
Boulder City, Nev	—	0	21	21	0	8	8
Yuma, Ariz	—	0	0	0	1	9	10
Columbia River:							
Pasco, Wash	—	13	115	128	<1	<1	1
Bonneville Dam, Oreg	—	9	76	85	0	1	1
Clatskanie, Oreg	1.1	21	54	75	0	0	0
McNary Dam, Oreg	—	8	64	72	0	<1	<1
Connecticut River: Northfield, Mass	—	0	6	6	0	0	0
Delaware River:							
Martins Creek, Pa	0.4	—	—	—	—	—	—
Philadelphia, Pa	—	5	6	11	0	0	0
Great Lakes:							
Detroit, Mich	—	0	0	0	2	0	2
Port Huron, Mich	—	0	0	0	0	0	0
Milwaukee, Wis	0.3	—	—	—	—	—	—
Sault St. Marie, Mich	—	0	3	3	0	1	1
Duluth, Minn	—	0	3	3	0	0	0
Hudson River: Poughkeepsie, N. Y	0.5	0	0	0	0	0	0
Illinois River: Peoria, Ill	—	5	0	5	1	2	3
Klamath River: Copco, Oreg	0.3	0	0	0	0	0	0
Little Miami River: Cincinnati, Ohio	—	0	<1	<1	1	1	2
Mississippi River:							
Dubuque, Iowa	—	0	0	0	0	4	4
Burlington, Iowa	—	3	11	14	1	0	1
E. St. Louis, Ill	0.5	7	12	19	0	1	1
Cape Girardeau, Mo	—	37	0	37	10	1	11
West Memphis, Ark	—	4	0	4	—	—	—
Delta, La	—	35	22	57	16	0	16
New Orleans, La	0.6	—	—	—	—	—	—
Missouri River:							
Bismarck, N. Dak	0.6	—	—	—	—	—	—
Omaha, Nebr	0.7	—	—	—	—	—	—
St. Joseph, Mo	—	62	0	62	25	3	28
St. Louis, Mo	—	41	16	57	12	1	13
Monongahela River: Pittsburgh, Pa	—	0	0	0	0	1	1
Ohio River:							
East Liverpool, Ohio	—	0	0	0	0	0	0
Huntington, W. Va	—	0	2	2	1	0	1
Louisville, Ky	—	4	2	6	0	1	1
Evansville, Ind	—	0	3	3	1	1	2
Cairo, Ill	—	5	8	13	0	1	1
Potomac River: Williamsport, Md	0.8	—	—	—	—	—	—
Red River, North: Grand Forks, N. Dak	1.5	—	—	—	—	—	—
Red River, South:							
Index, Ark	—	1	0	1	2	3	5
Denison, Tex	—	0	0	0	0	1	1
Rio Grande River:							
Alamosa, Colo	—	3	23	26	0	2	2
El Paso, Tex	—	6	14	20	2	2	4
Brownsville, Tex	0.3	0	0	0	—	—	—
Roanoke River: John H. Kerr Reservoir and Dam, Va	—	2	<1	2	0	0	0
Sabine River: Ruliff, Tex	0.8	3	7	10	1	1	2
St. Lawrence River: Massena, N. Y	—	0	0	0	0	2	2
Schuylkill River: Philadelphia, Pa	—	6	7	13	0	0	0
Savannah River:							
Port Wentworth, Ga	0.5	2	7	9	1	0	1
North Augusta, S. C	0.5	0	0	0	0	0	0
Snake River: Wawawai, Wash	—	1	7	8	0	1	1
South Platte River: Julesburg, Colo	—	0	131	131	0	124	124
Susquehanna River: Sayre, Pa	—	0	4	4	0	0	0
Tennessee River:							
Chattanooga, Tenn	—	0	58	58	0	0	0
Bridgeport, Ala	0.9	4	46	50	0	0	0
Yakima River: Richland, Wash	—	1	5	6	0	3	3
Yellowstone River: Sidney, Mont	0.8	35	12	47	12	3	15

[a] Dash denotes no sample received or no determinations made.

All data reported in table 1 represent the average of all information available for the period indicated. Reported strontium–90 data are the results of determinations on three-month composite samples for a quarter ending in the month shown. The data were determined on analytical schedules in effect till September 1, 1961.

Additional information and data may be obtained from the following sources:

(1) *National Water Quality Network Annual Compilation of Data*, PHS Publication No. 663, Water Years 1957–58, 1958–59, 1959–60. Public Health Service, Division of Water Supply and Pollution Control, Washington 25, D. C.

(2) "Report on National Water Quality Control Network," submitted by Dr. F. J. Weber, Chief, Division of Radiological Health, PHS, at the Joint Committee on Atomic Energy Hearings on Fallout from Nuclear Weapons Tests, Vol. 1, May 1959, pages 167–169.

(3) Setter, L. R., J. E. Regnier, and A. Diephaus, "Radioactivity of Surface Waters in the United States," J. AWWA *51*, 1377 (1959).

(4) Straub, C. P., L. R. Setter, A. Goldin, and P. F. Hallbach, "Strontium–90 in Surface Waters," J. AWWA *52*, 756 (1960).

(5) Setter, L. R., and S. L. Baker, "Radioactivity of Surface Waters in the United States," *Radiological Health Data*, Vol. I, No. 7 (1960).

SECTION V. — OTHER DATA

External Gamma Activity

Radiation Surveillance Network, Public Health Service

Portable survey instruments are available at stations of the Radiation Surveillance Network for recording levels of external gamma radiation. Measurements are made daily approximately three feet above the ground. These readings are not precise but are sufficiently accurate to illustrate any significant variations above background. The differences among the values shown in the following tables are within the variance anticipated due to differences in normal background and in instrument response characteristics.

TABLE 1.—EXTERNAL GAMMA ACTIVITY, OCTOBER 1961

Station location		Average (mr/hr)	Station location		Average (mr/hr)
City	State		City	State	
Anchorage	Alaska	0.01	Pascagoula	Mississippi	0.01
Fairbanks	Alaska	0.01	Helena	Montana	0.03
Juneau	Alaska	0.01	Trenton	New Jersey	0.02
Kodiak	Alaska	0.01	Sante Fe	New Mexico	0.04
Phoenix	Arizona	0.02	Albany	New York	0.03
Little Rock	Arkansas	0.01	Gastonia	North Carolina	0.02
Berkeley	California	0.01	Bismark	North Dakota	0.01
Los Angeles	California	0.01	Columbus	Ohio	0.01
Denver	Colorado	0.02	Oklahoma City	Oklahoma	0.01
Hartford	Connecticut	0.01	Ponca City	Oklahoma	0.04
Washington	District of Columbia	0.02	Portland	Oregon	0.02
Jacksonville	Florida	0.01	Harrisburg	Pennsylvania	0.01
Miami	Florida	0.02	San Juan	Puerto Rico	0.01
Atlanta	Georgia	0.02	Providence	Rhode Island	0.02
Honolulu	Hawaii	0.03	Columbia	South Carolina	0.02
Boise	Idaho	0.02	Pierre	South Dakota	0.02
Springfield	Illinois	0.01	Nashville	Tennessee	0.01
Indianapolis	Indiana	0.01	Austin	Texas	0.01
Iowa City	Iowa	0.03	El Paso	Texas	0.02
Topeka	Kansas	0.02	Salt Lake City	Utah	0.02
Frankfort	Kentucky	0.01	Richmond	Virginia	0.01
New Orleans	Louisiana	0.01	Seattle	Washington	0.01
Baltimore	Maryland	0.01	Madison	Wisconsin	0.01
Lawrence	Massachusetts	0.02	Cheyenne	Wyoming	0.02
Lansing	Michigan	0.02	Jefferson City	Missouri	0.01
Minneapolis	Minnesota	0.01			
Jackson	Mississippi	0.01	Network average		0.02

Cesium-137 Levels in Humans

Walter Reed Army Institute of Research, Washington, D.C., and
U.S. Army Medical Research Unit, Landstuhl, Germany

The whole body counting facilities at the Walter Reed Army Institute of Research (WRAIR), Washington, D.C., and the Medical Research Unit, Landstuhl, Germany, have continued their program for measuring the levels of cesium–137 in people. A description of each facility and previous data were summarized in *Radiological Health Data*, Volume II, Number 4; subsequent data appeared in Volume II, Numbers 7 and 10.

This report presents results from Germany for the period June through August 1961, and from Walter Reed for the third quarter of 1961. The Landstuhl data are listed by month in table 1 and the Walter Reed data are listed by geographic area in tables 2 and 3.

TABLE 1.—ASSAYS PERFORMED AT THE U.S. ARMY MEDICAL RESEARCH UNIT, LANDSTUHL, GERMANY

Date	Subjects residing in	Number of subjects	$\mu\mu c$ Cs^{137}/gm K (average)
June 1961	West Germany	291	33
July 1961	West Germany	450	32
August 1961	West Germany	260	37

TABLE 2.—ASSAYS PERFORMED AT THE WALTER REED ARMY INSTITUTE OF RESEARCH, THIRD QUARTER, 1961

Geographic area	Number of subjects	$\mu\mu c$ Cs^{137}/gm K (average)
Europe	5	41
Far East	2	31
Pacific Islands	4	20
United States	61	22

TABLE 3.—ASSAYS OF INDIVIDUALS RESIDING WITHIN THE UNITED STATES PERFORMED AT WRAIR, THIRD QUARTER, 1961

State	Number of subjects	$\mu\mu c$ Cs^{137}/gm K (average)
Alabama	1	0
Arizona	2	3
California	7	23
Colorado	1	0
District of Columbia	7	24
Florida	1	62
Georgia	1	28
Kansas	2	33
Maryland	4	25
Massachusetts	2	1
Michigan	1	28
New Jersey	1	19
North Carolina	2	32
Ohio	1	0
Oklahoma	2	19
Pennsylvania	4	21
Rhode Island	5	28
Texas	9	21
Virginia	7	21
Washington	1	29

TABLE 4.—SUMMARY OF TABLES 1 and 2—THIRD QUARTER, 1961

Geographic area	Number subjects	$\mu\mu c$ Cs^{137}/gm K (average)	Percent MPC [1]
Europe	5	41	0.21
Far East	2	31	0.16
Pacific Island	4	20	0.10
United States	61	22	0.11
West Germany	1001	[2] 34	0.17

[1] *Radiological Health Data*, Volume II, Number 4, pages 193 and 194.
[2] Values represent determinations for June through August 1961.

Environmental Levels of Radioactivity at Atomic Energy Commission Installations

The U.S. Atomic Energy Commission transmits to the Public Health Service quarterly reports on the environmental levels of radioactivity in the vicinity of major Commission installations. The reports include data from routine monitoring programs where operations are of such a nature that plant perimeter surveys are required.

Summaries of the environmental radioactivity data for 18 AEC installations have appeared in *Radiological Health Data,* Volume I, Numbers 8 and 9; and Volume II, Numbers 1 through 12. Summaries follow for Brookhaven National Laboratory, Mound Laboratory, National Reactor Testing Station, Oak Ridge Area, and Paducah Plant for the first and second quarters of 1961.

The measured concentrations of radioactive substances in air and water may be compared with the Maximum Permissible Concentration (MPC) of that substance as recommended by the National Committee on Radiation Protection and Measurements (NCRP). For the general population, the applicable MPC's are one-tenth of the occupational values for continuous exposure as given in National Bureau of Standards Handbook 69.

For the purpose of clarity and perspective, a few of the applicable environmental MPC values are listed in table 1. Such values are intended as guides only. For further clarification, Handbook 69 should be consulted.

The establishment of MPC's does not imply that each nuclide may be present at 100% of its MPC concentration. If the concentration of each nuclide is expressed in terms of percent of its MPC, then the sum of all the percent values should not exceed 100%.

In the following reports, the use of terms such as "total activity," "total alpha," and "gross beta" do not in themselves suggest any one MPC value. Often, when concentrations are low a laboratory will assign an MPC value that is more restrictive than necessary. This avoids the more costly isotopic analyses necessary to justify a less restrictive value. References to table 1 will be made to designate the appropriate MPC's when reported by the laboratory.

TABLE 1.—SELECTED ENVIRONMENTAL MPC VALUES PERTAINING TO AEC INSTALLATION REPORTS IN THIS SUBSECTION

Line no.	Radioactive substance	Environmental MPC's	
		Water ($\mu\mu$c/liter)	Air ($\mu\mu$c/m^3)
1	Cerium-144	10,000	300
2	Cesium-137	20,000	500
3	Cobalt-60	30,000	300
4	Iodine-131	2,000	300
5	Plutonium-239	5,000	0.06
6	Polonium-210	700	20
7	Ruthenium-106—rhodium-106	10,000	200
8	Strontium-90	100	10
9	Thorium-234—protactinium-234	20,000	1,000
10	Uranium-natural	20,000	2
11	If Sr^{90}, I^{129}, Pb^{210}, Po^{210}, At^{211}, Ra^{223}, Ra^{224}, Ra^{226}, Ac^{227}, Ra^{228}, Th^{230}, Pa^{231}, Th^{232}, and Th-nat are not present [1]	3,000	—
12	If Sr^{90}, Pb^{210}, Ra^{226}, Ra^{228} are not present [1]	600	—
13	If Ra^{226}, Ra^{228} are not present [1]	100	—
14	Mixture of unidentified nuclides	10	0.04
15	If α emitters and Ac^{227} are not present [1]	—	1.0
16	If α emitters and Pb^{210}, Ac^{227}, Ra^{228}, and Pu^{241} are not present [1]	—	10
17	If α emitters and Sr^{90}, I^{129}, Pb^{210}, Ac^{227}, Ra^{228}, Pa^{230}, Pu^{241}, and Bk^{249} are not present [1]	—	100

[1] "Not present" implies the concentration of the nuclide is small compared with its appropriate MPC. According to recent FRC recommendations a group of nuclides may be considered not present if the ratio of the concentration of each nuclide to its appropriate MPC is equal to or less than 1/10 and if the sum of these ratios for the group in question is equal to or less than 1/4.

Brookhaven National Laboratory

Associated Universities, Inc., Upton, New York
—Issued October 1961

Previous coverage in *Radiological Health Data*

Period covered:	Issue:
1959 and first quarter 1960	Volume I, Number 9
Second quarter 1960	Volume II, Number 2
Third and fourth quarters 1960	Volume II, Number 6

The following report summarizes the environmental levels of radioactivity at the Brookhaven National Laboratory (BNL) for the first and second quarters of 1961.

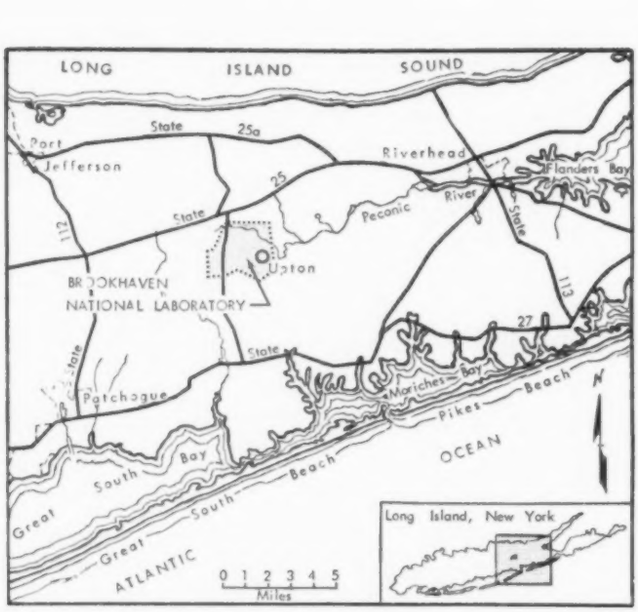

FIGURE 1.—BROOKHAVEN NATIONAL LABORATORY AND SURROUNDING AREA

Laboratory operations affect the levels of radiation in the vicinity of BNL in two ways: (1) by the discharge of coolant air from the graphite research reactor, and (2) by the discharge of low level radioactive liquid wastes into a small stream that forms one of the headwaters of the Peconic River.

Air Monitoring

The radioactivity in the discharged coolant air is almost entirely that of argon–41, a beta-gamma emitter. Because the most critical exposure to argon–41 is that of external gamma, the monitoring is performed by measuring the dose-rate in milliroentgens per week (mr/wk) rather than the concentration in air. The environmental maximum permissible dose recommended by NCRP is 0.5 r/yr (10 mr/wk) above natural background, averaged over a one-year period.

Table 2 presents the average dose rate measured at each of the four monitoring stations, three of which are on the site boundary.

TABLE 2.—GAMMA LEVELS ON SITE BOUNDARY DUE TO COOLANT AIR EFFLUENT

[Average dose rates in mr/week]

Period--1961	North gate (680 meters inside boundary)	Southwest perimeter	Southeast perimeter	Northeast perimeter
First quarter	0.79	1.11	4.17	1.17
Second quarter	2.04	1.21	1.22	2.49

Water Monitoring

The BNL liquid waste effluent is monitored for gross beta concentrations at the site boundary. Table 3 presents the average concentration together with the total activity released as determined by using known effluent flow rates.

TABLE 3.—GROSS BETA ACTIVITY IN LIQUID WASTE EFFLUENT

Period—1961	Average effluent flow rate (million gallons/day	Average beta concentration ($\mu\mu$c/liter)	Total beta activity millicuries
First quarter	0.445	230	35.2
Second quarter	1.478	120	61.2

Mound Laboratory

Monsanto Chemical Company
Miamisburg, Ohio
—Issued September 1961

Previous Coverage in *Radiological Health Data*

Period covered:	Issue:
1959 and first quarter 1960	Volume I, Number 8
Second and third quarters 1960	Volume II, Number 3
Fourth quarter 1960	Volume II, Number 8

Environmental levels of radioactivity at the Mound Laboratory for the first and second quarters, 1961 are summarized in the following report. During that time, no radioactive materials were used which contributed any measurable penetrating radiation such as gamma or hard beta to the environment. Polonium, plutonium, and tritium are possible air contaminants, and polonium and tritium are possible river water contaminants.

Air Monitoring

A continuous air monitor for measurement of tritium and particulate air sampling equipment for measurement of alpha activity mounted on a one-ton panel truck are used in the routine monitoring of the environmental air.

Figures 2 and 3 show 95 locations up to 20 miles from the laboratory at which air samples are taken. The selection of sampling sites depends on the wind direction on the days that samples are collected. Samples are collected downwind from the plant according to routes drawn up for the different wind directions. It is quite likely that not all sites will be sampled during any one quarter.

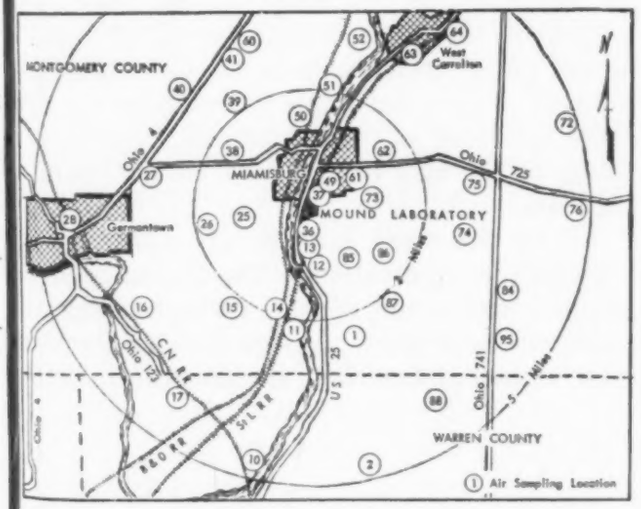

FIGURE 2.—CLOSE-IN AIR SAMPLING LOCATIONS, MOUND LABORATORY

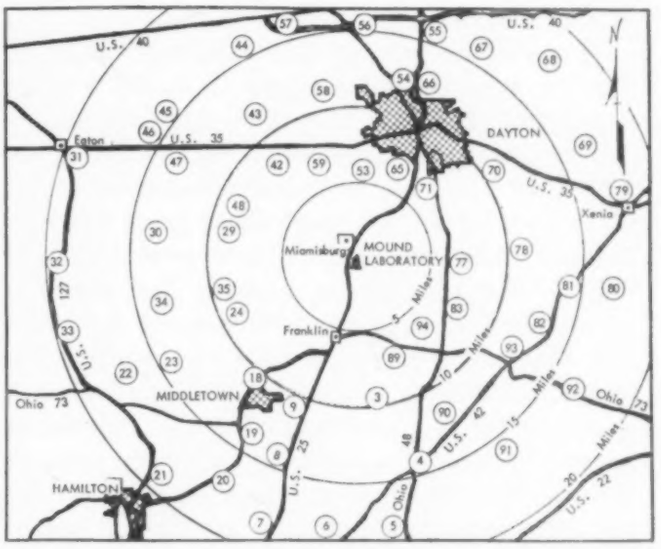

FIGURE 3.—DISTANT AIR SAMPLING LOCATIONS, MOUND LABORATORY

A total of 231 samples were taken for determination of tritium in air during the first and second quarters, 1961. In all cases the tritium concentration was below the minimum level of detection.

Monitoring for possible polonium and plutonium released to the environment is accomplished by determination of long-lived gross alpha on filter paper samples. Counting was done in a low background proportional counter after sufficient time had elapsed after collection to permit the decay of short-lived daughter products of radon and thoron. The average alpha concentrations in air at different distances from the Laboratory are given in table 4.

If all the alpha activity were assumed to be polonium it would be about 0.05% of the MPC for polonium as given in table 1. However, polonium effluent stack monitoring indicated

TABLE 4.—GROSS ALPHA ACTIVITY IN AIR

Sampling location zone (distance in miles from laboratory)	First quarter 1961		Second quarter 1961	
	No. of samples	Average concentration ($\mu\mu c/m^3$)	No. of samples	Average concentration ($\mu\mu c/m^3$)
0—2	24	0.0073	19	0.0055
2—5	41	0.0074	35	0.0079
5—10	26	0.0064	17	0.0057
10—15	28	0.0106	24	0.0092
15—20	35	0.0142	29	0.0192
All samples	154	0.0093	124	0.0101

that no detectable polonium should be found in the environment due to the operations of Mound Laboratory.

If the alpha activity were assumed to be all plutonium, it would amount to a much more significant 16% of the MPC for plutonium. Again the stack monitoring results are quite meaningful. The average concentration of plutonium in the air discharged from the plutonium stack was well within environmental limits. For this reason, and the fact that the air is discharged to the environment from the 200 foot stack at high velocity yielding appreciable dilution, it is seen that the plutonium operations have contributed an insignificant burden to the radioactivity normally present in the atmosphere. It is also pointed out that the natural alpha concentration in air in southwestern Ohio is in the range of and frequently exceeds the MPC for plutonium.

Water Monitoring

Liquid radioactive waste materials from polonium work at the laboratory are processed in a special waste disposal plant designed to reduce radioactivity to a concentration level at which it may be discharged to the Great Miami River. Liquid waste from the plutonium work is small in volume. It is handled separately as a packaged waste and is not discharged to the river. Helium–3 being purified at Mound Laboratory yields small quantities of tritium. Liquid wastes from this work, also small in volume are treated separately (diluted with water when necessary) to assure that the radioactive content is within the maximum permissible concentration for discharge to the Great Miami River.

Water samples are collected weekly from a drainage ditch and five locations along the Great Miami River as shown in figure 4. The

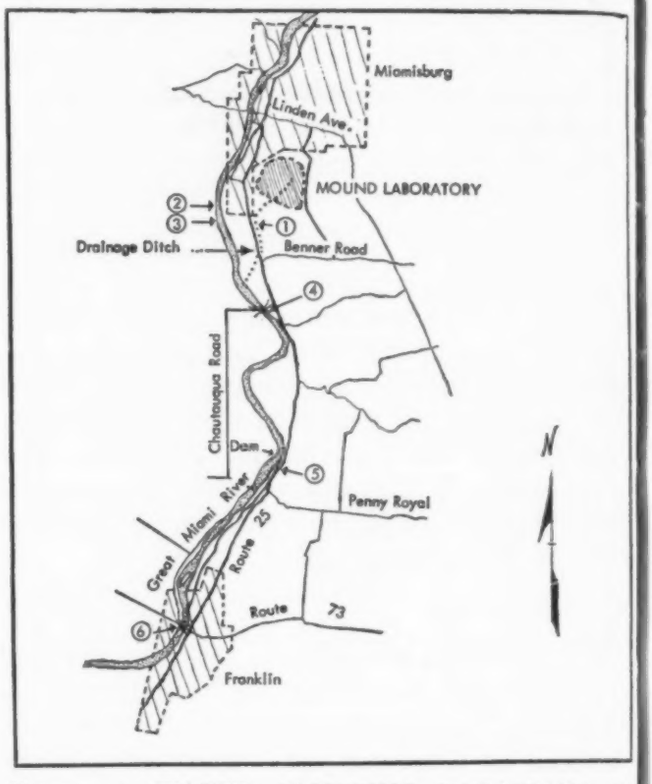

FIGURE 4.—WATER SAMPLING LOCATIONS IN GREAT MIAMI RIVER, MOUND LABORATORY

drainage ditch carries away all storm sewer water and liquid tritium wastes from the plant site. Sampling location number 2 is located at the point of discharge of the laboratory effluent to the Great Miami River. Number 6 is five miles downstream from the effluent discharge. Additional single downstream samples were collected at five locations (beyond the limits of the map in figure 4) during the first quarter.

All of the river samples are analyzed for polonium concentration. The drainage ditch samples and some of the river samples are analyzed for tritium. Average concentrations of polonium and tritium are given in table 5.

TABLE 5.—OFF-SITE WATER MONITORING FOR POLONIUM AND TRITIUM

[Average concentrations in μμc/liter]

Station code No. (see figure 4)	First quarter 1961				Second quarter 1961			
	Tritium		Polonium		Tritium		Polonium	
	No. of samples	Concentration	No. of samples	Concentration	No. of samples	Concentration	No. of samples	Concentration
1	9	222,000	0	----------	13	1,230,000	0	----------
2	7	ND[b]	9	9.6	13	692,000	13	8.59
3	0	----------	9	1.21	0	----------	13	1.66
4	7	ND	9	0.20	13	769,000	13	1.39
5	0	----------	9	1.60	0	----------	13	1.53
6	0	----------	9	1.80	0	----------	13	1.53
None[a]	0	----------	5	ND	0	----------	0	----------

[a] Single samples were collected at five downstream locations between Franklin and Elizabethtown, Ohio.
[b] ND = No detectable activity.

National Reactor Testing Station

Health and Safety Division

Atomic Energy Commission
Idaho Falls, Idaho

First and Second Quarters 1961

—Issued September 1961

Previous coverage in *Radiological Health Data*

Period covered:	Issue:
1959 and first quarter 1960	Volume I, Number 9
Second Quarter 1960	Volume II, Number 2
Third and fourth quarters 1960	Volume II, Number 5

Descriptions and discussions of the monitoring network procedures have been adequately presented in the earlier issues referred to above. Certain modifications for increased efficiency and coverage were initiated in January, 1961. Figure 5 shows the current sampling locations. The monitoring network improvements were as follows:

a. Revision of milk sampling station locations to obtain samples from additional dairy herds on the periphery of the NRTS.
b. Additional off-site underground water sampling stations to provide control samples from populated areas upstream on water gradient.
c. Additional air monitoring coverage to the southwest of the NRTS.
d. Addition of 14 area monitoring badges at off-site air monitoring locations to replace badges originally located at various points within the Station.

The SL–1 accident on January 3, 1961, did not release sufficient quantities of radioactivity to approach the established RCG or RPG levels as recommended by the Federal Radiation Council. Increased radioactivity was observed on air filters located at Atomic City and Aberdeen, Idaho. Milk samples collected from dairy herds between Atomic City and Springfield, Idaho indicated possible iodine–131 at the detection levels of 200 μμc/liter. However, the levels detected in all cases were considerably below the established guide values.

Table 6 presents the environmental monitoring data for the first and second quarters for 1961 together with averages for the 1960 calendar year.

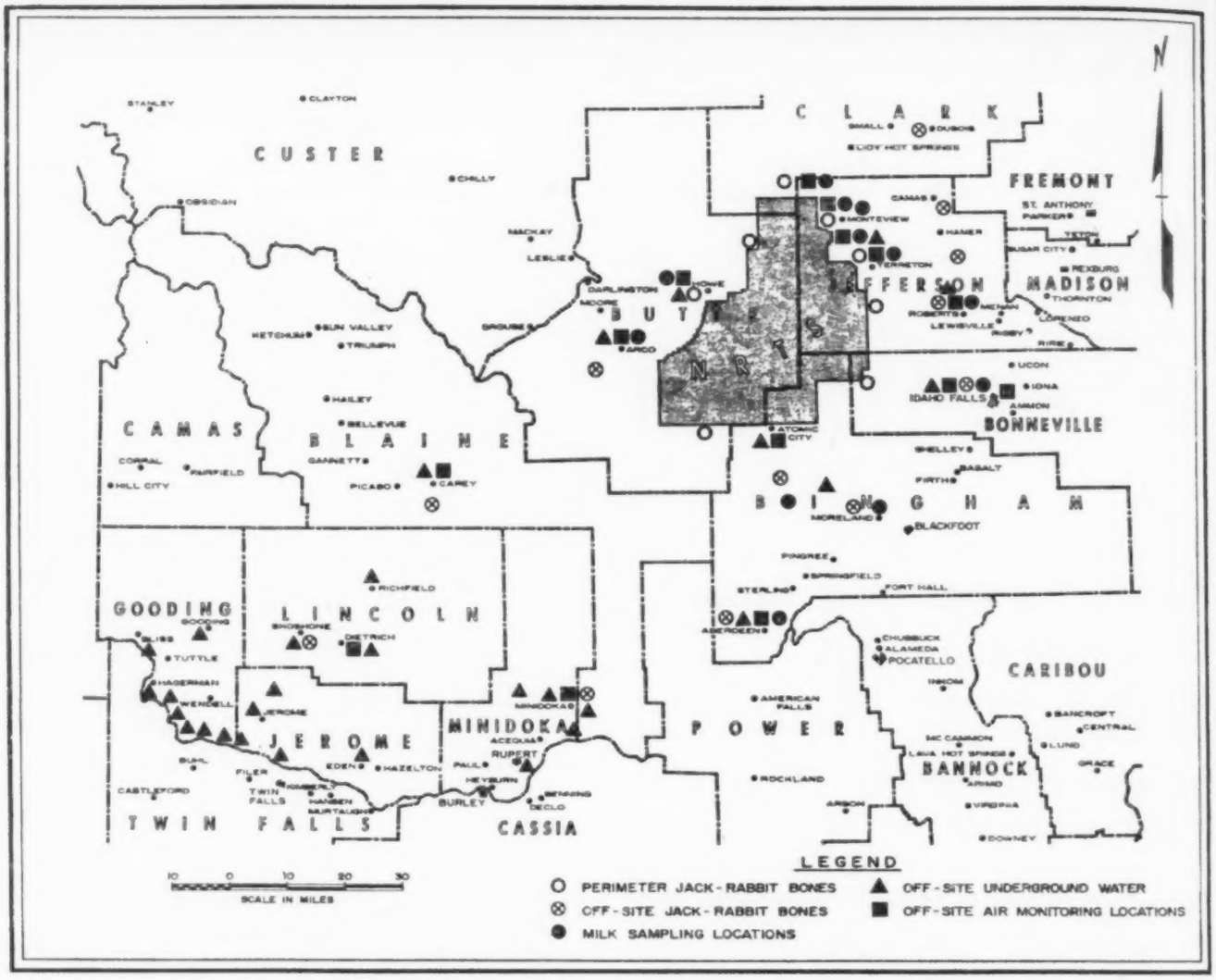

FIGURE 5.—ENVIRONMENTAL MONITORING STATIONS, NATIONAL REACTOR TESTING STATION

TABLE 6.—ENVIRONMENTAL MONITORING PROGRAM DATA

Type of sample and units	Calendar year 1960		First quarter 1961		Second quarter 1961	
	Number of samples	Average activity	Number of samples	Average activity	Number of samples	Average activity
Off-site underground water ($\mu\mu$c/liter)	151	α: < 3.1 β: <150	56	α: < 3 β: <150	30	α: < 3 β: <150
On-site underground water ($\mu\mu$c/liter)	779	α: < 3.1 β: <150	216	α: < 3 β: <160	172	α: < 3 β: <150
Off-site air filters ($\mu\mu$c/m^3)	379	β: < 1.4	189	β: 1.6	123	β: 1
Perimeter jack rabbit bones[1] ($\mu\mu$c Sr^{90}/g Ca)	45	< 16	13	17	12	14
Off-site jack rabbit bones[1] ($\mu\mu$c Sr^{90}/g Ca)	68	< 18	25	12	21	8
Off-site milk ($\mu\mu$c I^{131}/liter)	790	<600	91	200	39	<200
Area monitoring badges (mrem)	897	(Total for year) γ: <160 β: <125	42	(Total for quarter) γ: < 60 β: < 30	28	(Total for quarter) α: < 30 β: < 30

[1] The reporting of strontium-90 in jackrabbit bones lags the collection of the samples by one-quarter year.

Oak Ridge Area

Union Carbide Nuclear Company
Oak Ridge, Tennessee

First and Second Quarters 1961
—Issued October 1961

Previous coverage of Oak Ridge Area (under the title—Oak Ridge National Laboratory) in *Radiological Health Data* is as follows:

Periods covered:	Issue:
1959 and 1st quarter 1960	Volume I, No. 9
2nd and 3rd quarters 1960	Volume II, No. 3
4th quarter 1960	Volume II, No. 7

This report presents first and second quarter 1961 data on the environmental levels of radioactivity for the Oak Ridge Area. As shown in figure 6, K–25 Area, X–10 Area, and Y–12 Area are located within the large AEC controlled Oak Ridge Area. The Oak Ridge National Laboratory (ORNL) is located within the X–10 Area and the Oak Ridge Gaseous Diffusion Plant (ORGDP) is located within the K–25 Area.

Radioactive waste materials arising from the operation of atomic energy installations at Oak Ridge are collected, treated, and disposed of according to their physical states.

Solid wastes are buried in a Conasauga shale formation. This shale has a marked ability to fix radioactive materials by an ion exchange mechanism.

Liquid wastes which contain long-lived fission products are confined in storage tanks or are released to pits located in the Conasauga shale formation. Low level liquid wastes are discharged, after preliminary treatment, to the surface streams.

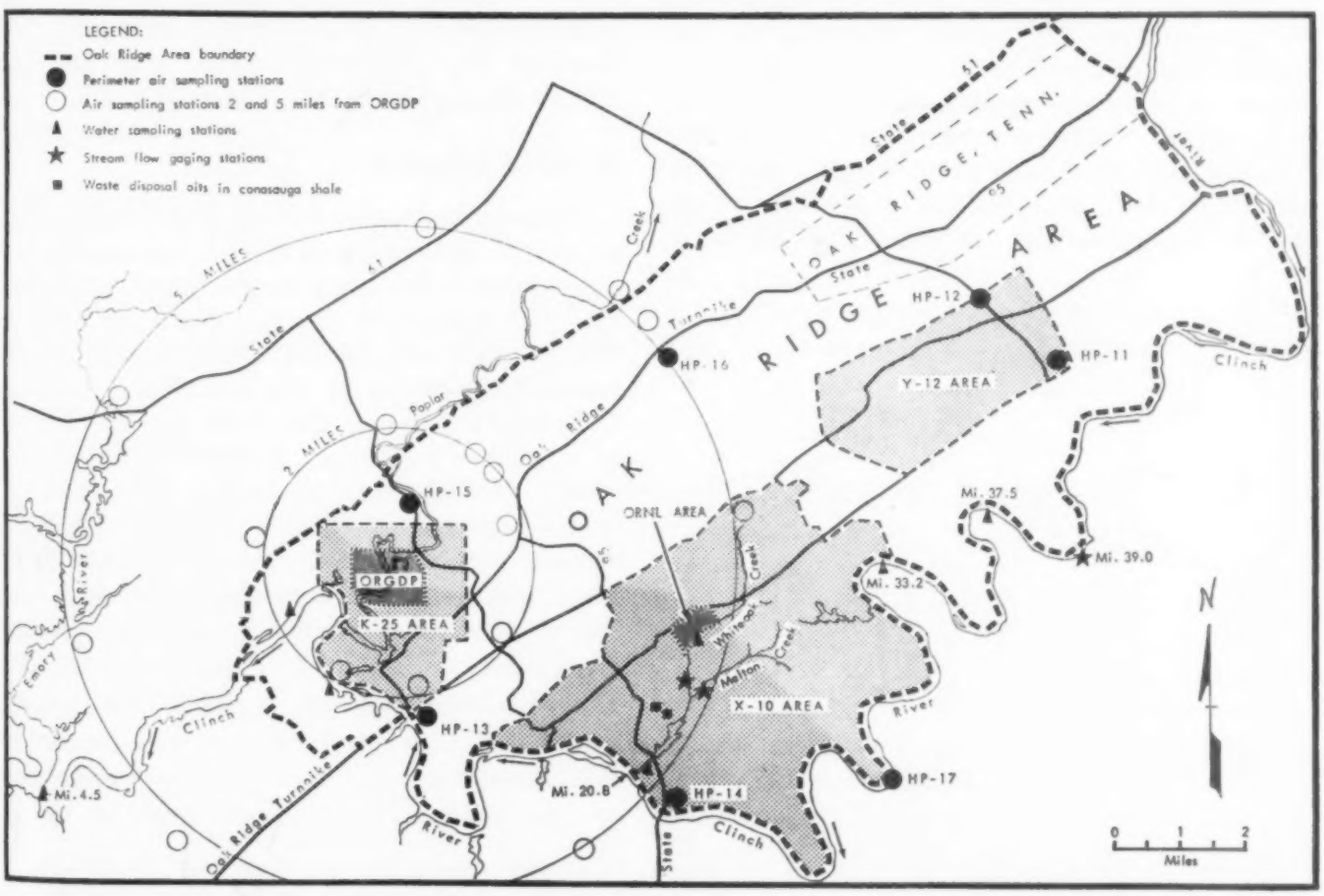

FIGURE 6.—OAK RIDGE AREA ENVIRONMENTAL SAMPLING LOCATIONS

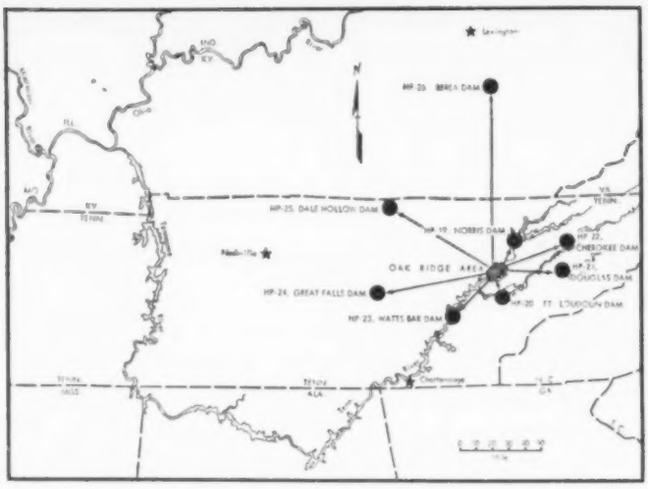

FIGURE 7.—REMOTE AIR MONITORING STATIONS, OAK RIDGE AREA

Air that may become contaminated by radioactive materials is exhausted to the atmosphere from several tall stacks after treatment by means of filters, scrubbers, and/or precipitators.

Air Monitoring

Atmospheric contamination by long-lived fission products and fallout occurring in the general environment of eastern Tennessee are monitored by two systems of monitoring stations. One system consists of seven stations which encircle the plant area (Fig. 6) and provides data for evaluating the impact of all Oak Ridge Operations on the immediate environment. A second system consists of eight stations encircling the Oak Ridge Area at distances of from 12 to 120 miles (figure 7). This system provides data to aid in evaluating local conditions and to assist in determining the spread of contamination should a major incident occur. Sampling is carried out by passing air continuously through a filter paper. Average concentrations are tabulated in table 7. The measured uranium concentrations are reported in table 8.

TABLE 7.—LONG-LIVED GROSS BETA CONCENTRATIONS IN AIR

[Average concentrations in $\mu\mu c/m^3$]

Station number (*see figures 6 and 7*)	First quarter 1961		Second quarter 1961	
	Number of samples	Average gross β	Number of samples	Average gross β
Perimeter stations:				
HP-11	13	0.057	14	0.091
HP-12	13	0.088	14	0.163
HP-13	14	0.052	14	0.099
HP-14	14	0.051	14	0.094
HP-15	13	0.065	13	0.138
HP-16	13	0.054	14	0.150
HP-17	13	0.054	14	0.096
All perimeter stations	93	0.060	97	0.119
Remote stations:				
HP-19	13	0.064	14	0.100
HP-20	13	0.054	13	0.099
HP-21	13	0.062	13	0.104
HP-22	14	0.050	14	0.086
HP-23	13	0.052	13	0.097
HP-24	13	0.050	13	0.096
HP-25	13	0.055	13	0.097
HP-26	13	0.053	13	0.086
All remote stations	105	0.055	106	0.095

TABLE 8.—URANIUM CONCENTRATIONS IN AIR NEAR THE OAK RIDGE GASEOUS DIFFUSION PLANT

[Average concentrations in $\mu\mu c/m^3$]

Distance from center of plant	First quarter 1961		Second quarter 1961	
	Number of samples	Uranium concentration	Number of samples	Uranium concentration
2 miles	16	0.041	0	----------
5 miles	16	0.103	16	0.13

Atmospheric contamination by uranium is determined by taking periodic air samples at eight locations on a three-mile radius and eight locations on a five-mile radius from the Oak Ridge Gaseous Diffusion Plant (fig. 6).

Water Monitoring

Large volume, low level liquid wastes originating at Oak Ridge National Laboratory are discharged, after some preliminary treatment, into the Tennessee River system by way of White Oak Creek and the Clinch River. Liquid wastes originating at the Oak Ridge Gaseous Diffusion Plant and the Y–12 are discharged to Poplar Creek and thence to the Clinch River. Releases are controlled so that resulting average concentrations in the Clinch River comply with the maximum permissible levels for populations in the neighborhood of a controlled area as recommended by the National Committee on Radiation Protection (NCRP). The concentration of radioactivity leaving White Oak Creek is measured and concentration values for the Clinch River are calculated on the basis of the dilution provided by the river.

Water samples are taken at a number of locations in the Clinch River, beginning at a

TABLE 9.—CONCENTRATIONS OF MAJOR RADIONUCLIDES IN THE CLINCH RIVER

[Average concentrations in $\mu\mu c$/liter]

Radionuclide	First quarter 1961			Second quarter 1961		
	Location on Clinch River[a]			Location on Clinch River[a]		
	Mi. 37.5 (Upstream)	Mi. 20.8[b] (Outfall)	Mi. 4.5 (Downstream)	Mi. 33.2 (Upstream)	Mi. 20.8[b] (Outfall)	Mi. 4.5 (Downstream)
Sr^{90}	0.5	13	7.8	0.5	6.0	3.7
Ce^{144}	0.1	2.3	0.6	0.4	0.8	0.5
Cs^{137}	ND[c]	5.1	Trace	0.4	5.4	0.9
$Ru^{103-106}$	ND	730	480	ND	670	350
Co^{60}	ND	15	7.2	0.1	12	5
Gross Beta	3.9	1200	670	4.4	1200	400

[a] The location on Clinch River is given in terms of the distance upstream from the Tennessee River. See figure 6.
[b] The concentrations at mi. 20.8 are not measured directly but the values calculated on the basis of levels of waste released and the dilution afforded by the river.
[c] ND—None detected.

point above the entry of wastes into the river and ending at Center's Ferry near Kingston, Tennessee. Stream gauging operations are carried on continuously by the United States Geological Survey to obtain dilution factors for calculating the probable concentrations of wastes in the river.

Samples are analyzed for the long-lived beta emitters, for uranium, and for the transuranic alpha emitters. The averages are tabulated in tables 9 and 10.

TABLE 10.—URANIUM CONCENTRATIONS IN THE CLINCH RIVER

[Average concentrations in $\mu\mu c$/liter]

Sampling location	First quarter 1961		Second quarter 1961	
	Number of samples	Uranium concentration	Number of samples	Uranium concentration
Upstream from ORGDP	14	1.1	13	2.3
Downstream from ORGDP	13	1.7	11	3.2

Gamma Measurements

External gamma radiation levels are measured monthly at a number of locations in the Oak Ridge Area. Measurements are taken with a Geiger-Mueller tube at a distance of three feet above ground, and the results are tabulated in table 11 in terms of mr/hr.

TABLE 11.—EXTERNAL GAMMA RADIATION LEVELS

[Average dose rates in mr/hr]

Location	First quarter 1961	Second quarter 1961
Solway gate	0.016	0.014
Y-12 east portal	0.013	0.014
Newcomb Road	0.013	0.014
Gallaher gate	0.017	0.014
White Wing gate	0.014	0.013
Average	0.015	0.014

Paducah Plant

Union Carbide Nuclear Company
Paducah, Kentucky

First and Second Quarters 1961
—Issued September 1961

Previous coverage in *Radiological Health Data:*

Period covered:	Issue:
1959 and first quarter 1960	Volume I, Number 9
Second and third quarters 1960	Volume II, Number 3
Fourth quarter 1960	Volume II, Number 7

The Paducah Plant is a Government owned gaseous diffusion plant operated by Union Carbide Nuclear Company for the Atomic Energy Commission. The gaseous diffusion plant, the associated uranium hexafluoride manufacturing plant, and uranium metal foundry process large quantities of relatively pure uranium

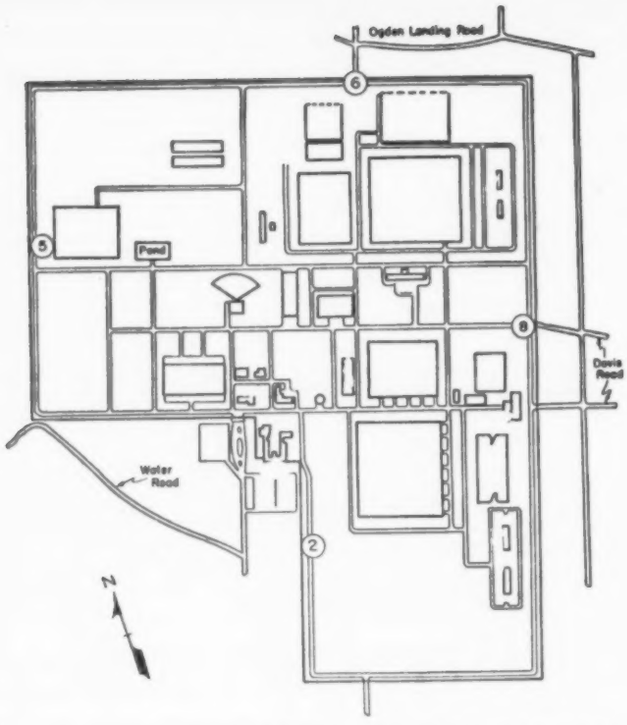

FIGURE 8.—AIR SAMPLING POSITIONS, PADUCAH GASEOUS DIFFUSION PLANT

compounds. The major sources of external penetrating radiation from such materials are the daughter-product isotopes of thorium and protactinium formed by alpha decay and subsequent beta decay of the parent uranium. These isotopes are concentrated in the ash produced during the fluorination process. The element uranium can be a physiological hazard only if it enters the body. The chemical toxicity of the uranium materials processed at the Paducah Plant overshadows any radiation danger from this element, making it a physiological risk comparable to lead, mercury, or other well-known heavy metals.

Uranium is a rather expensive material, and thus represents a great incentive to recover as much as is economically feasible. To protect the population and to maintain a wholesome relationship with neighboring communities and individuals, the air is exhausted through filters, and all effluent waters are discharged at extremely low concentrations of uranium.

Since no recovery process or filtering system is 100 percent effective an environmental monitoring program is used to evaluate the effectiveness of such measures. The Paducah Plant Environmental Monitoring Program consists of a continuing system for sampling air at four stations around the plant perimeter fence, and four off-site stations; and for sampling water at two locations in Big Bayou Creek, and four locations on the Ohio River as shown in figures 8 and 9. Tables 12 and 13 present the air and water monitoring data.

TABLE 12.—RADIOACTIVITY IN AIR

[Average concentrations in $\mu\mu c/m^3$]

Sampling station number	First quarter 1961			Second quarter 1961		
	Number of samples	Uranium	Gross beta	Number of samples	Uranium	Gross beta
On-site:						
2	13	<0.07	<0.30	13	<0.07	0.32
5	13	<0.07	<0.30	13	<0.07	<0.30
6	13	0.12	0.99	13	<0.07	0.90
8	13	<0.07	<0.30	13	<0.07	0.37
Overall	52	<0.07	0.39	52	<0.07	0.46
Off-site:						
South	4	<0.07	<0.30	13	<0.07	<0.30
West	4	<0.07	<0.30	13	<0.07	<0.30
North	4	<0.07	<0.30	13	<0.07	<0.30
East	4	<0.07	<0.30	13	<0.07	<0.30
Overall	16	<0.07	<0.30	52	<0.07	<0.30

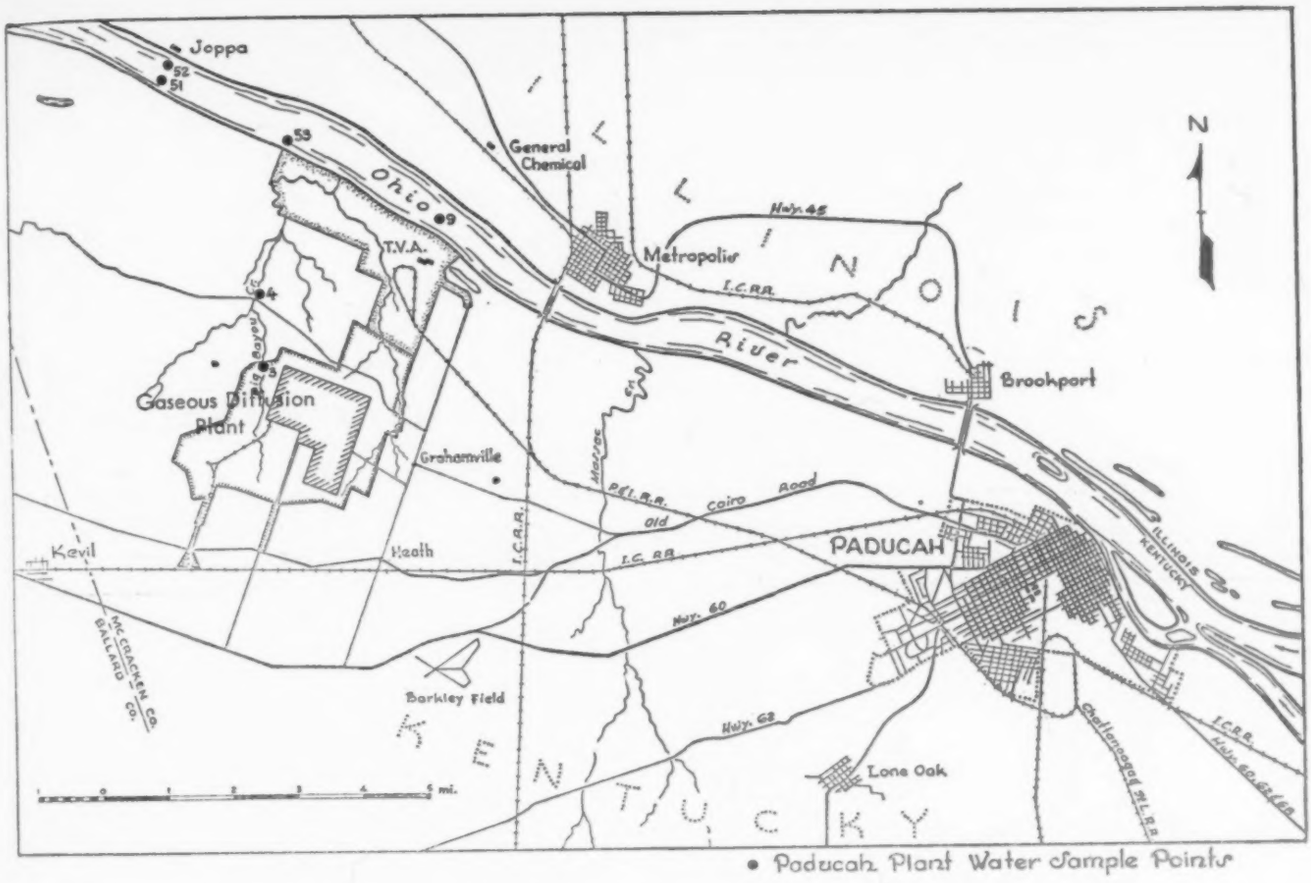

FIGURE 9.—WATER SAMPLING LOCATIONS, PADUCAH GASEOUS DIFFUSION PLANT

TABLE 13.—RADIOACTIVITY IN WATER

[Average concentrations in $\mu\mu c$/liter]

Sampling station number	First quarter 1961			Second quarter 1961		
	Number of samples	Uranium	Gross beta	Number of samples	Uranium	Gross beta
3	13	25	300	13	9	200
4	3	13	100	3	7	400
9	6	1	100	6	1	400
51	6	1	200	6	1	200
52	6	1	100	6	<1	200
53	6	<1	100	6	<1	100

Announced Nuclear Detonations

Radiological Health Data, Volume II, Numbers 10, 11, and 12 published the dates of the Union of Soviet Socialist Republics and the United States announced nuclear detonations through December 3, 1961. The following table gives information on the subsequent tests reported through January 1, 1962. Low yield range has been announced as meaning about a nominal (20 kiloton) yield; low-intermediate to mean between a nominal and one megaton yield.

Test Number	Location	Date	Size	Type of test
ANNOUNCED U.S. DETONATIONS				
6	Carsbad, New Mexico	December 10	5 KT	Underground, Operation Gnome, Plowshare Program.
7	Nevada Test Site	December 13	Low yield	Underground.
8	Nevada Test Site	December 17	Low yield	Underground.
9	Nevada Test Site	December 22	Low yield	Underground.

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